PROCEEDINGS

OF THE

GENERAL MEETINGS FOR SCIENTIFIC BUSINESS

OF THE

ZOOLOGICAL SOCIETY

OF LONDON.

1907, pp. 447–1121.

(MAY—DECEMBER.)

PRINTED FOR THE SOCIETY,

AND SOLD AT THEIR HOUSE IN HANOVER SQUARE.

LONDON:

MESSRS. LONGMANS, GREEN, AND CO.,

PATERNOSTER ROW.

LIST

OF THE

COUNCIL AND OFFICERS

OF THE

ZOOLOGICAL SOCIETY OF LONDON.

1908.

COUNCIL.

His Grace The Duke of Bedford, K.G., *President*.

George A. Boulenger, Esq., F.R.S., *Vice-President*.
Prof. J. Rose Bradford, M.D., D.Sc., F.R.S., *Vice-President*.
Alfred H. Cocks, Esq.
The Rt. Hon. The Earl of Cromer, P.C., G.C.B.
Charles Drummond, Esq., *Treasurer*.
Sir Edward Durand, Bt., C.B.
Frederick Gillett, Esq., *Vice-President*.
F. Du Cane Godman, Esq., D.C.L., F.R.S., *Vice-President*.
The Marquis of Hamilton, M.P.
E. G. B. Meade-Waldo, Esq.
Prof. Edward A. Minchin, M.A., *Vice-President*.
P. Chalmers Mitchell, Esq., M.A., D.Sc., LL.D., F.R.S., *Secretary*.
The Lord Newton.
W. R. Ogilvie-Grant, Esq.
Albert Pam, Esq.
The Hon. N. Charles Rothschild, M.A.
David Seth-Smith, Esq.
Oldfield Thomas, Esq., F.R.S.
A. Trevor-Battye, Esq., M.A.
Henry Woodward, Esq., LL.D., F.R.S., *Vice-President*.

PRINCIPAL OFFICERS.

P. Chalmers Mitchell, M.A., D.Sc., LL.D., F.R.S., *Secretary*.
Frank E. Beddard, M.A., F.R.S., *Prosector*.
R. I. Pocock, F.L.S., *Superintendent of the Gardens*.
Henry G. Plimmer, M.R.C.S., *Pathologist*.
F. H. Waterhouse, *Librarian*.
John Barrow, *Accountant*.
W. H. Cole, *Chief Clerk*.
Arthur Thomson, *Assistant Superintendent of the Gardens*.

LIST OF CONTENTS.

1907, pp. 447–1121.

May 7, 1907.

May 28, 1907.

November 12, 1907.

November 26, 1907.

December 10, 1907.

ALPHABETICAL LIST

OF THE

CONTRIBUTORS,

With References to the several Articles contributed by each.

(1907, pp. 447–1121.)

LIST OF PLATES.

1907, pp. 447–1121.

LIST OF TEXT-FIGURES.

1907, pp. 447–1121.

LIST OF NEW GENERIC TERMS

PROPOSED IN THE PRESENT VOLUME (pp. 447–1121).

PROCEEDINGS

OF THE

GENERAL MEETINGS FOR SCIENTIFIC BUSINESS

OF THE

ZOOLOGICAL SOCIETY

OF LONDON.

1907.

PAGES 447–746.

CONTAINING PAPERS READ IN

MAY AND JUNE.

OCTOBER 1907.

PRINTED FOR THE SOCIETY,
SOLD AT THEIR HOUSE IN HANOVER SQUARE.

LONDON:
MESSRS. LONGMANS, GREEN, AND CO.,
PATERNOSTER-ROW.

[*Price Twelve Shillings.*]

LIST OF CONTENTS.

1907, pp. 447–746.

May 7, 1907.

May 28, 1907.

Contents continued on page 3 of Wrapper.

PROCEEDINGS

OF THE

GENERAL MEETINGS FOR SCIENTIFIC BUSINESS

OF THE

ZOOLOGICAL SOCIETY OF LONDON.

(May to December, 1907.)

May 7, 1907.

G. A. Boulenger, Esq., F.R.S., Vice-President, in the Chair.

Mr. H. B. Fantham, B.Sc., F.Z.S., exhibited original drawings of *Spirochæta anodontæ* from the crystalline style and intestine of *Anodonta cygnea*. This was the first record of the occurrence of that parasite in the British Pond-Mussel, though Keysselitz recorded probably the same organism from *Anodonta mutabilis* about a year ago, without giving its dimensions. The organism was found to be about 40 μ long and about 0·7 μ broad, with pointed ends and an undulating membrane. Its motion was most rapid, but seemed to be both spiral and vibratory.

The Secretary, Dr. P. Chalmers Mitchell, F.R.S., exhibited photographs of a young male African Elephant, which had been given him by Mr. W. T. Hornaday, C.M.Z.S., Director of the Bronx Zoological Park, New York, and made the following remarks:—

On a recent visit to the New York Zoological Gardens, I was much interested by a young African Elephant, labelled *Elephas cyclotis* Matschie, but which was unlike any Elephant that I had seen alive or described. From its general shape and appearance, and particularly from its possession of well-formed conical tusks which I judged to be about eight inches in length, the animal was evidently not a baby, and yet it was not more than about four feet high at the shoulder. It was dark in colour; its ears were very much smaller relatively than those of any African Elephant I knew, and had an unfamiliar outline; finally, the tip of the trunk showed a peculiarity new to me.

Since returning to London, I find that Prof. Th. Noack described under the name *Elephas africanus pumilio* (Zool. Anz. xxix. p. 631) a young African Elephant from the French Congo, then in the possession of Mr. Carl Hagenbeck, but shortly to be sent to America. I have no doubt that this is the same individual, and I have little to add to the points by which Dr. Noack distinguished it from the *cyclotis* of Matschie, except to point out that *cyclotis* was described as light in colour, whereas this form has a very dark skin. This dwarf African Elephant, however, differs from any African Elephant that I have seen, and approaches the condition in the Indian Elephant, in a point which Dr. Noack did not mention. The tip of the trunk of the Indian Elephant, by which it can pick up objects, consists of a long finger-shaped, median dorsal process which fits over a much shorter and thicker lower lip with a median groove, making it almost bi-lobed. In every African Elephant that I have hitherto seen, the dorsal and ventral lips of the trunk are rounded, triangular processes, similar in shape and practically equal in size and thickness. In the New York example of *E. africanus pumilio*, however, the lower lip is relatively shorter than in the normal African condition, although it is not grooved in the middle line as in the Indian form, whilst the upper lip is a relatively slender, almost finger-shaped process, much longer than the lower lip. I hope that those who have opportunities of observing the formation of the tip of the trunk in the different phases of the African Elephant, will pay attention to this point.

Mr. A. Trevor-Battye, M.A., F.L.S., F.Z.S., read notes on some constructional features in Continental Zoological Gardens.

These notes were the outcome of recent visits paid by the writer to the Gardens of Hamburg, Berlin, Dresden, Vienna, Budapest, Munich, Frankfort-am-Main, Cologne, Düsseldorf, Amsterdam, Rotterdam, and Antwerp. They dealt with the improvements upon former methods made in the case of new cages, buildings and enclosures. The Gardens of Berlin, Breslau, Vienna, and Rotterdam were stated to be especially deserving of a careful visit.

A tendency to get rid, so far as possible, of bars and wiring was noticeable. At Stellingen, as was well known, most of the animals were confined in "natural" fastnesses; while at Antwerp even the Giraffes were separated from their visitors only by enormous sheets of plate glass.

The small Rodents' House at Berlin was singled out for particular commendation on the score of ingenuity and completeness for its purpose. The plans of this building were shown, by the kindness of Dr. Heck, Director of the Berlin Zoological Gardens.

It had come to be more and more fully realised that the majority of creatures from warm—even from tropical—countries would thrive well even in the winter of an English climate, with access to the outer air. In the Dresden Monkey-house, and in others constructed on the same plan as our own in London, this had been secured by the simple device of a wired gangway or bridge from the central cages to those outside. Even the Chimpanzees take advantage of this, letting themselves in and out. At Berlin, the Great Ant-eater was thriving in a paddock, in October. The remarkable Monkey-house at Rotterdam was fully described and illustrated by large working plans of its construction, kindly lent by Dr. Büttikofer, the Director of the Rotterdam Zoological Gardens. The Falconnier system of glazing in use here was recommended for reptiles and birds.

The Storage, Workshops, and Infirmary buildings at Rotterdam were explained by means of the original working plans.

The Deer-house of Breslau was instanced as probably the best in Europe. This house, constructed at an expenditure of only £900, was built of pine logs. In it the following points were worth remembering:—1. Doors all sliding one way, so that they can be worked from the central corridor. 2. A ventilator to each box. 3. Feeding troughs movable up and down (according to size of the animal), and opened outwards for filling. 4. Enamelled water-troughs running in and out on tram-lines. 5. Screens of spruce between the yards. 6. A gallery running round outside the building so that the animals could be viewed from above. 7. Food stored above the boxes, on air-tight floors.

The magnificent "Flight Cage" for birds in Antwerp was constructed in 1906. It is about 180 ft. long, 70 ft. wide, 60 ft. high. Instead of being built tent-wise, like ours in London, that loss of space was avoided, and equal stability secured, by large arched wings which acted as buttresses and formed an immense addition to the capacity of the Aviary.

The standing difficulty of how to prevent smell in such houses as those of the small Carnivora and Edentata had been got over in Frankfort and elsewhere by the following simple device. Hot-water pipes were carried along the *front* of the cage, while a glass screen, some 5 or 6 feet high, was placed about 4 feet from the cages, and a ventilator constructed towards the back of the cages, but in the roof. The warm air, passing out, hit the screen, was thus deflected and went up through the cages and out at the ventilator. It carried all the smell away with it; there was literally none where the visitors stood.

In the Schönbrunn Zoological Gardens—the most beautiful of all—not only the Polar Bears but also the Brown and Black Bears are given large water-tanks in which they spend most of the day very happily, being by nature water-loving animals and not frequenters of "bear-pits."

Although the buildings in many Continental Zoological Gardens were originally modelled on those in Regent's Park, our neighbours had now perhaps gone ahead of us in some directions. While we need not follow them in the fanciful design and coloured decoration of some of their modern buildings—these things being a matter of temperament and taste—we should do well in the future to turn our attention more carefully to improved methods of warming, lighting, and ventilation, to convenience in feeding and cleaning, and particularly to the question of admission of sunlight and air.

Mr. Trevor-Battye, in conclusion, expressed his sense of the courtesy, kindness and ready accessibility of the Directors of the Gardens visited.

The following papers were read:—

1. The Marine Fauna of Zanzibar and East Africa, from Collections made by Cyril Crossland in 1901–1902.—The Cephalopoda. By WILLIAM E. HOYLE, M.A., D.Sc.*

[Received April 26, 1907.]

(Plate XX.† and Text-figures 128–137.)

The collection of Cephalopoda from Zanzibar placed in my hands by Mr. Cyril Crossland is not a large one, but its investigation has brought out several points of interest.

Of the forms here recorded five were among the collections made by Professor Herdman in Ceylon (Hoyle, :**05**), whilst four are also found in the Red Sea, thus indicating considerable homogeneity in the Cephalopoda of the northern and north-eastern parts of the Indian Ocean.

Certain Octopod embryos exhibited very clearly the bristle-like processes noticed but not yet fully described by Chun (:**04**) and myself ('**05** A). I have, therefore, taken the opportunity of giving an account of them with illustrations.

I have to record my thanks to Mr. Crossland for the opportunity of studying the collection, and to Miss Ethel M. Curwen, F.Z.S., for making some of the drawings.

The numbers in square brackets refer to my own register of specimens examined.

* Communicated by Dr. H. W. MARETT TIMS.

† For explanation of the Plate, see p. 461.

M. P. Parker lith.

Parker & West imp.

CEPHALOPODA FROM ZANZIBAR.

LIST OF SPECIES.

POLYPUS HORSTI. (Plate XX. figs. 1, 2, 3 & 12.)

Octopus horsti Joubin ('98) p. 23.

Localities.—Zanzibar, shallow water at low tide, 1901 [157]. Zanzibar, shore, 1–2 fathoms, eastern reefs [158, 161, 161 A].

Previous record.—Djeddah, Red Sea (*Joubin*).

The most striking character of this species is the zebra-like pattern on the ventral surface of the arms shown in Pl. XX. fig. 12.

Specimen 158 is in very poor condition and the ocellar spots very faint, especially the one on the right side.

Specimen 161 has indications of small warts (two to four) over each eye, instead of one large and one small one as in Joubin's

Text-fig. 128.

Extremity of the hectocotylised arm of *Polypus horsti*; × 3.

type. The ocellar spot is fairly distinct, in the best marked example (161 A, left side) it has a rather dark centre 10 × 11 mm., surrounded by a paler ring from 2 to 4 mm. in breadth, and there is a small wart in the middle of it. The size of the spot seems to vary with the degree of contraction. The hectocotylised extremity of the arm (text-fig. 128) measures 5 mm. from the last sucker to the tip; it is 1·75 mm. in breadth and has a central groove 0·5 mm.

across without any transverse ridges in it. The groove which runs along the arm is very wide and well-marked; 5 cm. from the tip it measures 2 mm. across when opened out; it is crossed by a series of narrow close-set ridges, of which there are about three to a millimetre.

In several specimens the arms have been lost and show different stages in the process of repair. In 161 the second right arm had been removed just above the umbrella margin, and its present condition is shown in Pl. XX. fig. 1. The two suckers project far above the cut end of the arm, and appear to have been drawn over by the contraction of tissues consequent on the healing process. The cross section of the arm is now much less than that of a normal arm at the same level. Just within the integument is a small fleshy, curved process (*r*), the rudiment which will grow into the new arm. Further stages may be seen in 157, where no less than four arms have been amputated and are in different stages of regeneration. In the fourth left arm (Pl. XX. fig. 2) the rudiment is 8 mm. in length and bears about thirty suckers; the exact number is impossible to ascertain, those towards the tip being very minute. In the third right arm (Pl. XX. fig. 3) the length of the restored portion is 15 mm., but the number of suckers has not much increased, being only about thirty-eight; their size is, however, much greater. The chief point of interest about these specimens is that in every case the rudiment of the new arm arises in the same position, namely just within the integument of the outer aspect of the arm.

Text-fig. 129.

Radula of *Polypus horsti*; × 65.

As the radula of this species has not yet been figured, I give a drawing of it in text-fig. 129.

Polypus horsti is very commonly used for food in Zanzibar, and

Mr. Crossland has furnished the following notes on its capture and preparation by the Swahili :—

"All the larger Cephalopoda are eaten by the natives of Zanzibar, though the most prized species is the largest and most abundant, *Polypus horsti*. At low spring tides this is found hiding in the small but proportionately deep crevices of the reef-edge, the presence of a specimen being indicated outside only by the movement of the water from the mantle-cavity, if at all.

"The whole apparatus, apart from his means of access to the reef-edge, required by the Octopus fisher consists of half-a-dozen switches a foot or two long. With these he probes the hiding place until the inmate is compelled slowly to come out, which it does usually by crawling up the stick on which it is impaled.

"When the animal is alive its colour varies between yellow-ochre and chocolate-brown, and may be mottled or uniform. During this process of torture, however, the colour varies rapidly and irregularly, and when dying distinct waves of chocolate-brown pass quickly over the now greyish body, the colour becoming more and more restricted and the waves less frequent until all pigment finally disappears so that the animal, when dead, is uniformly grey.

"The further preparation of the body was observed during my stay on the islet of Mnemba, which is situated off the N.E. coast of Zanzibar. Although the whole opposite coast is extremely sparsely inhabited, a considerable number of fishermen assemble here at the time of spring tides for the collection of Octopus from the edges of the great reef upon which the islet stands, and the products of their fishing are exported to all parts of Zanzibar.

"One would think that such portions as the liver and genital gland would be the most edible of all, but the first step in the treatment consists in the removal of *all* the viscera, from the ink-gland to the œsophagus. Seated on the sand, the fisherman then subjects the empty carcase to a very thorough beating with a heavy piece of wood, after which the body is kneaded vigorously for a considerable time. Presumably this violent and prolonged treatment has for its object the reduction of the indiarubber-like consistence of the muscle and connective tissues, but such tenacity have these soft bodies that but little visible effect is produced upon them.

"The clear space in the centre of the islet is now occupied by scores of Octopus hung in rows to dry, threaded upon sticks which are supported in the forks of uprights at each end at a height of three or four feet from the ground. During this drying, the dead Octopus, never in appearance an attractive object, becomes of a dull red colour, which with the putrid smell which is soon emitted makes the beasts appear a particularly revolting form of carrion. However, the natives (including my own boat boys) evidently regard them as a delicacy, and I am assured by an English resident that they are not at all unpalatable when thoroughly boiled."

POLYPUS ARBORESCENS.

Polypus arborescens Hoyle (:**04**) p. 189, pl. 2. figs. 8, 9, 12, & pl. 3.

Localities.—Zanzibar, Khotoni Harbour, October 23rd, 1901, 5 fathoms, Daleni; one young specimen, ♀ [167].

Zanzibar, Wasin, dredged in the harbour near the N.E. mouth, 10 fathoms; four young specimens, ♀ [168–171]; one young specimen, ♂ [176 A].

Previous record.—Ceylon (*Hoyle*).

POLYPUS HORRIDUS.

Octopus horridus d'Orbigny (**'26**) p. 54; Férussac & d'Orbigny (**'35**) p. 51.

Polypus horridus Hoyle (:**04**) p. 194, pl. 2. figs. 10, 13 (entered by error as *P. aculeatus*); Id. (:**05**) p. 978.

Locality.—Zanzibar, Wasin, dredged in harbour near the N.E. mouth, 10 fathoms; two young specimens, ♀ [172, 181].

Previous records.—Red Sea, Egyptian shore (*d'Orbigny*); Cape of Good Hope (*Krauss*); Ceylon (*Hoyle*); Male Atoll (*Hoyle*).

POLYPUS HERDMANI.

Polypus herdmani Hoyle (:**04**) p. 187, pl. 1.

Locality.—Zanzibar, Chuaka Bay, April 18th, 1901; one young specimen, ♀ [176].

Zanzibar, Wasin, N.E. entrance of harbour, 10 fathoms; two young specimens, one ♀ [179], one sex? [179 A].

Previous record.—Ceylon (*Hoyle*).

At first I took no. 176 to be a male, with the third arm on the right side hectocotylised, but further examination showed that there was no groove along the ventral aspect of the arm, and that the modified tip had about half-a-dozen minute suckers upon it in two rows, instead of the spoon-shaped depression. I conclude, therefore, that it is a female in which this arm has been mutilated and is in process of repair.

Specimens 179, 179 A I think belong to this species; the warts are very pronounced. They have been stained of a dark colour by a specimen of *Antedon carinata* which was packed in the same vessel.

POLYPUS C.

Polypus C, Hoyle (:**04**) p. 196, pl. 2. figs. 2, 5.

Locality.—Zanzibar, Wasin, 10 fathoms, dredged near N.E. mouth of harbour; one young specimen [177].

Previous record.—Ceylon.

POLYPUS E?

Polypus E, Hoyle (:**04**) p. 196.

Locality.—Zanzibar, Chuaka Bay, dredged April 18th, 1901; one specimen, ♀ [175].

A specimen measuring 12 mm. from the posterior end of the mantle to the eye, and with arms from 25 to 30 mm. in length, closely resembles a small Octopod obtained by Professor Herdman from the west coast of Ceylon and recorded as *Polypus* E in the Report on his investigations. The upper surface is slightly granular and there is a minute papilla above and behind each eye.

Polypus L.

Polypus L, Hoyle (:**05**) p. 980, figs. 147–150.

Locality.—Zanzibar, Wasin, 10 fathoms, dredged near N.E. mouth of harbour; one young specimen, ♂ [180].

Previous record.—Hulule, Male Atoll (*Hoyle*).

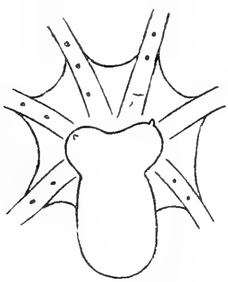
This is very near the young specimen from the Maldive Archipelago, which I have called *Polypus* L. It has the three conspicuous chromatophores on the ventral surface and the equidistant ones on the outer surface of the arms.

Polypus M. (Text-figs. 130, 131.)

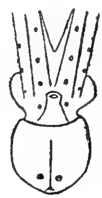
Locality.—Zanzibar, Chuaka Bay, dredged April 18th, 1901; two young specimens, sex ? [173, 174].

These two young specimens closely resemble two from the Gulf of Manaar, called *Polypus* H in my Report on Prof. Herdman's

Text-fig. 130.



Text-fig. 131.



Text-figs. 130, 131.—Dorsal and ventral aspects of *Polypus* M; × 2.

collections from Ceylon (:**04**, p. 197). Their chief characters are a rounded saccular body with a deep groove in the middle line below, a single papilla over each eye, and a single row of large chromatophores up the outer side of each arm, and two, instead of three, conspicuous chromatophores on the lower aspect of the mantle. There are rudiments of a few papillæ on the dorsal surface of the mantle of the larger specimen.

Polypus sp. juv.

Localities.—Zanzibar, Wasin, 6 fathoms, February 10th, 1902, one specimen [166]; Wasin, 10 fathoms, dredged near N.E. mouth of harbour, one specimen [178].

These are two small examples which do not present adequate characters for description.

SEPIOTEUTHIS LOLIGINIFORMIS.

Chondrosepia loliginiformis Rüppell & Leuckart (**'28**) p. 21, pl. 6. fig. 1.

Sepioteuthis loliginiformis Férussac & d'Orbigny (**'35**) p. 299, pl. 4. fig. 1; Joubin (**'98**) p. 27.

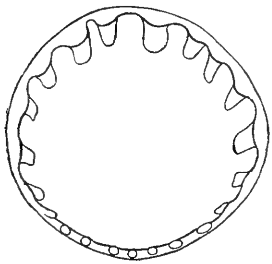
Localities.—Zanzibar, 1901, shallow water, low tide; five specimens, 2 ♂ [153, 154], 3 ♀ [155, 156, 160]; Eastern Reefs, one young specimen [163].

Previous record.—Red Sea.

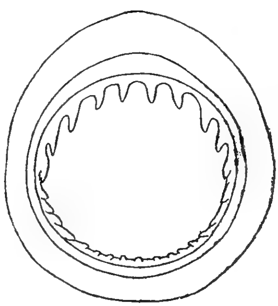
The Body is long, subconical, bluntly pointed behind; the *fin* extends the full length of the body; it is suboval, broadest just behind the middle.

The Head is short and nearly equal in breadth to the body; the *eyes* are large, with a minute pore like a pin-prick just in front of each; the *auditory crest* has a sigmoid curve and a similar pore in the concavity of the lower half. The *buccal membrane* is attached by seven ligaments (the dorsal one bifurcating) to the eight arms; each point of the membrane bears near its tip five or six *suckers*, of which the *horny ring* bears in its two distal thirds twelve stout blunt teeth, whilst the proximal third has nine much smaller rounded denticles (text-fig. 132).

Text-fig. 132.



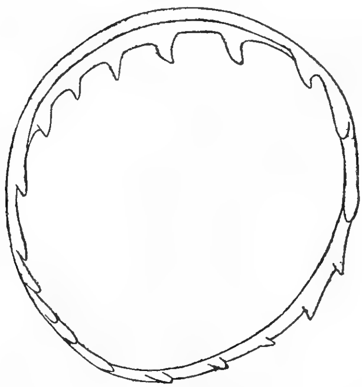
Text-fig. 133.



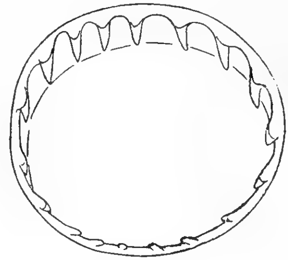
Text-fig. 132.—Horny ring of a buccal sucker of *Sepioteuthis loliginiformis*; × 75.
Text-fig. 133.—Sucker from a sessile arm of *Sepioteuthis loliginiformis*; × 20.

The Arms are unequal, the order of length being 3, 4, 2, 1. The *first* is keeled from the end of the first fifth nearly to the tip, with a well-developed protective membrane on either side of the sucker-bearing face, that on the ventral aspect being broader. The *second* is stouter and almost triangular in section; a keel extends from the membrane connecting it with the third arm along the outer aspect almost to the tip; the protective membranes on either side of the sucker-bearing face resemble those of the first pair. The *third* is the longest and stoutest, is keeled along its whole length and has protective membranes like those of the first. The *fourth* has two deep keels, one arising from the interbrachial membrane, the other from the inner ventral angle of the arm; the protective membranes are both very narrow. The *suckers* are in two rows throughout, hemispherical and obliquely set in their stalks; the *horny ring* (text-fig. 133) has about ten bluntly-pointed teeth on the distal semicircumference and about sixteen small blunt ones on the proximal. The tip of the left ventral arm is *hectocotylised*; the suckers in about its distal fifth become rapidly smaller and their peduncles proportionately larger, until the extreme tip of the arm is occupied by a double row of small conical processes.

Text-fig. 134.



Text-fig. 135.



Text-fig. 134.—Horny ring of a large tentacular sucker of *Sepioteuthis loliginiformis*; × 20.

Text-fig. 135.—Horny ring of a lateral tentacular sucker of *Sepioteuthis loliginiformis*; × 20.

The Tentacles are a little shorter than the mantle; the *stem* is elliptical in section; the *club* is expanded and prismatic; there is a distinct keel deepening into a membrane distally on the outer aspect; each side of the sucker-bearing face has a protective membrane, that on the ventral side being the wider. The *suckers* are in four series, those in the middle third being much enlarged; these have about twenty rather blunt teeth around the circumference of the horny ring (text-fig. 134); in the lateral suckers the horny ring has about ten acute teeth in its distal half and the same number of small blunt ones in the proximal (text-fig. 135).

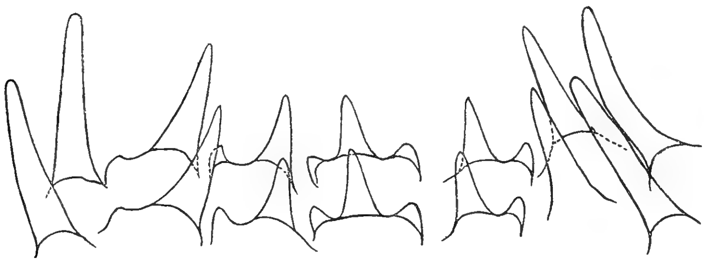
The Colour (in alcohol) is dark purplish above, shading into dull yellow below.

The Pen is thin and transparent, with a thick hollow keel, and on either side a thickened strip, which begins about halfway between the keel and the margin and does not extend quite as far outwards as the latter (text-fig. 136).

Text-fig. 136.

Transverse section through the pen of *Sepioteuthis loliginiformis.*

Text-fig. 137.



Two rows of teeth from the radula of *Sepioteuthis loliginiformis*; × 42.

The Radula has the form and arrangement shown in text-fig. 137.

Dimensions of No. 160.

	cm.
Length (total)	27
End of body to mantle-margin (dorsal)	16·7
,, ,, eye (centre)	16·5
Breadth of body	5·2
,, ,, head	4·5
Length of fin	15·5
Breadth of fin	9·3
Diameter of largest sucker on sessile arm	0·35
,, ,, ,, tentacle	0·5

	Right. cm.	Left. cm.
Length of first arm	5	4·5
,, ,, second arm	7·5	6·5
,, ,, third arm	8·5	8
,, ,, fourth arm	8	8
,, ,, tentacle	14	15·5

No full description of this species has ever been published, so I have thought it advisable to give one here, the more so as the type, which was presumably deposited with the rest of Rüppell's collection in the Senckenberg Museum at Frankfort, seems to have disappeared. I cannot find the "median ligament to the siphon" mentioned by Joubin ('**98**) p. 27.

Sepia singalensis.

Sepia singalensis Goodrich ('**96**) p. 3, pl. 1. figs. 4–8; Hoyle (:**04**) p. 198.

Localities.—Zanzibar, Eastern Reefs, 1901; two specimens, ♀ [159, 162].

Previous record.—Ceylon.

Mr. Crossland states that this species is "pretty common" at Zanzibar.

EGG-CAPSULES AND EMBRYOS.

Octopod. (Plate XX. figs. 4–11.)

Localities.—Zanzibar, 1901, East and West Reefs; egg-capsules [184].

Zanzibar, Eastern Reefs; newly-hatched embryos from capsules at the extremities of branched stalks [187].

Sections of these embryos showed very clearly the curious epithelial structures which have been briefly described by Chun (:**04**) as "Das Borstenkleid der Cephalopoden." In this instance, however, they are neither so numerous nor so closely packed as to form a coat. In the hinder half of the body there are but few, perhaps two to four in a transverse section (10 μ thick); whilst on the head they are more numerous, and at the bases of the arms there may be from ten to fourteen in a single section. Here, too, there are very many of them in the integument covering the eyes, which does not seem to have been the case in the forms examined by Chun.

None of my sections showed the first stages in their development. The earliest I could make out exhibits a rounded mass of homogeneous material (Pl. XX. fig. 4), which stains clearly but not deeply with hæmatoxylin and eosin. It measures about 0·02 mm. in diameter, and lies in a pit lined by epithelial cells. There is in close relation with it a large ovoid nucleus (Pl. XX. fig. 5). At first sight it appears as though this nucleus were situated within the homogeneous mass, but careful focussing and measurement show that it is always outside. The spheroidal mass gradually puts out a prominence on its superficial aspect and assumes a pyriform shape, which becomes more and more pronounced (Pl. XX. fig. 6).

The elongation rapidly becomes considerable until a club-shaped plug is produced, the head being turned inwards, the handle outwards (Pl. XX. fig. 7). The extreme length is about 0·06 mm., the head being 0·02 mm. in diameter. The head is elliptical or spheroidal and narrows rapidly into the stem, which then tapers gradually towards the distal extremity where it ends in a bluntly-rounded point. The distal portion stains rather more deeply than the proximal, except for a small space quite at the base.

At this stage signs of a longitudinal split are seen in the handle of the club (Pl. XX. fig. 8), and as soon as the tip of this has made its way through the integument several of these fissures are seen, extending from about one-third along the club to its distal extremity; they separate the handle of the club into from four to six branches, the splitting being seen by transverse section to take place from the centre towards the circumference (Pl. XX. fig. 9). When the integument has once been perforated the handle of the club rises above the surface, its divisions divaricate one from the other, and it assumes the form of a little tuft of bristles (Pl. XX. figs. 10 & 11). The half-dozen bristles first formed seem to undergo a further splitting, for in one instance I counted ten divisions, and in a few cases I noticed a radial striation in which it was impossible to count the individual threads.

The later stages I have not been able to follow out in the material at my disposal. I am inclined to think, however, that the epithelial structures with a radiating tuft of fibrils, described by me (:**04**, p. 193) in *Polypus arborescens*, may represent a later stage of a similar apparatus. If this be so, there can be no doubt that these bristle-tufts are of a cuticular nature, and the nucleus which I have described as occurring in some of them (:**04**, pl. 3. figs. 9, 11, & 12) must be based on a misinterpretation of the appearances.

It is not easy to say what is the function of these bunches of cuticular bristles, other than to suggest in a general way that they are protective. To point out, however, what they protect the embryo or newly-hatched larva from, or precisely how they act, is not so easy; and, as the material at my disposal is limited to one set of embryos at about the same stage of development, I prefer to leave the question for further investigation as opportunity may serve.

Sepia.

Localities.—Zanzibar, Khotoni Harbour, shore, 1901; egg-capsules [164] and embryos [165].

Decapoda undetermined.

Localities.—Zanzibar, Chuaka Bay, taken by the tow-net in shallow water; embryos [182].

Zanzibar, reefs at the mouth of Chuaka Bay, February 22nd, 1901; egg-capsules [186]. Mr. Crossland records that they were attached singly to the under surface of stones.

Zanzibar, under stones in Chuaka Bay, March 27th, 1901; embryos [185].

Bibliography.

Chun, C. [:**04**].—[Jugendliche Octopoden, deren gesamte Körperoberfläche einen Besatz von Borstenbüscheln aufweist.] *Verh. deutsch. zool. Ges.* 14 Versamml. p. 243; 1904.

Férussac & d'Orbigny. ['**35**].—Histoire naturelle générale et particulière des Céphalopodes acétabulifères, vivants et fossiles. Paris, 1835–48.

Goodrich, E. S. ['**96**].—Report on a Collection of Cephalopoda from the Calcutta Museum. *Trans. Linn. Soc., Zool.* (2) vol. vii. part i. 24 pp., 5 pls.; 1896.

Hoyle, W. E. [:**04**].—Cephalopoda, in: W. A. Herdman, Report on the Pearl-Oyster Fisheries of the Gulf of Manaar, vol. ii. pp. 185–200, 3 pls.; 1904.

Hoyle, W. E. [:**05**].—The Cephalopoda, in: J. Stanley Gardiner, The Fauna and Geography of the Maldive and Laccadive Archipelagoes, vol. ii. supplement 1, pp. 975–988, pl. 95; 1905.

Hoyle, W. E. [:**05** a].—[Exhibition of specimens of certain rare Cephalopoda.] *Proc. Manchester L. & P. Soc.* 1903–5, p. xiii, fig.; 1905.

Joubin, L. ['**98**].—Sur quelques Céphalopodes du Musée de Leyde et description de trois espèces nouvelles. *Notes Leyden Mus.* vol. xx. pp. 21–28; 1898.

d'Orbigny, A. D. ['**26**].—Tableau méthodique de la classe des Céphalopodes. *Ann. Sci. Nat.* vol. vii., 150 pp., 8 pls.; 1826.

Rüppell, E., & F. S. Leuckart. ['**28**].—Atlas zu der Reise im nördlichen Afrika. Neue wirbellose Thiere des rothen Meers. P. 22, pl. F. Frankfurt-am-Main, 1828.

EXPLANATION OF PLATE XX.

Figs. 1–3. Polypus horsti.

Showing three stages in the regeneration of the arms, natural size, p. 452.
r, rudiment of new arm.

Figs. 4–11. Octopod embryo.

Showing stages in the development of the tufts of cuticular bristles, × 600, p. 459.

Fig. 12. Polypus horsti.

Portion of an arm showing the zebra-like markings, natural size, p. 452.

2. The Duke of Bedford's Zoological Exploration in Eastern Asia.—V. Second List of Mammals from Korea. By Oldfield Thomas, F.R.S., F.Z.S.

[Received April 23, 1907.]

On his return from the Islands of Saghalien and Hokkaido Mr. Malcolm Anderson paid a second visit to Korea in order to supplement the collections obtained a year earlier, of which I gave an account in No. II. of the present series of papers *.

On the present occasion Mr. Anderson worked in the central part of Korea, in two districts respectively about 50 miles north-east of Seoul and the same distance south of it. With the former collection, which was from much further south, we have therefore a good representation of the small mammals of the peninsula.

As before, Mr. Anderson experienced very great difficulty in finding suitable collecting-ground, owing to the bareness and deforestation of the greater part of Korea. He was, however, able to secure a considerable number of species additional to his first set, several of them being new. Of these the most noteworthy is the Hamster (*Cricetulus*), no member of the group having been previously known from this region.

The special interest of the Mammals of Korea lies in their bearing on the problems relating to the Japanese insular fauna and its origin. A few years ago almost all the Mammals of Japan were supposed to be peculiar; but, thanks to the present systematic survey, we are finding that more and more of them are connected through intermediate forms, either by way of Saghalien or of Korea, with the corresponding species of the mainland. Later on, when further localities are investigated, we may hope to come to sounder conclusions about the origin of the Japanese fauna than have hitherto been possible. A study of the fauna of Manchuria would be particularly useful for that purpose, but at present the unsettled state of the country makes it impossible for a collector to work there unless supported by a large party.

As before, the valuable series of specimens, 70 in number, here described is presented to the National Museum by our President, the Duke of Bedford, K.G.

1. Crocidura lasiura Dobs.

♀. 1123. Penchan, 50 miles N.E. of Seoul.
♀. 1145. Kim-hoa, 65 miles N.E. of Seoul.
♂. 1146. Kaloguai, 55 miles N.E. of Seoul.
♂. 1153, 1160, 1167, 1175, 1180, 1196. ♀. 1163, 1174. Chong-ju, S. of Seoul, 500′–800′.

2. Crocidura coreæ Thos.

♀. 1124. Penchan, 50 miles N.E. of Seoul, 300′.

* P. Z. S. 1906, p. 858.

♂. 1131. Kim-hoa, 65 miles N.E. of Seoul, 300′.

♂. 1166. ♀. 1154. Chong-ju, Chung-Chong Prov., S. of Seoul, 500′–800′.

3. Mogera wogura coreana, subsp. n.

♂. 1143. Kim-hoa, 65 miles N.E. of Seoul, 300′, 19th Nov., 1906. B.M. No. 7.6.3.13. *Type.* (A specimen from Seoul presented by Mr. C. W. Campbell in 1891.)

General characters as in *M. wogura*; size intermediate between *M. w. kanai* and the large *M. w. kobeæ*, falling far short of the gigantic *M. robusta* of Vladivostok. Colour brown (dark "mouse-grey") as usual in *M. wogura*. Anterior upper premolar two-rooted, considerably higher than p^2.

Dimensions of the type:—

Head and body 135 mm.; tail 21; hind foot 20.

Skull: greatest length 37·5 mm.; basal length 32·5; greatest breadth 18·2; interorbital breadth 8·4; palatal length 16; front of canine to base of m^3 14·3.

Hab. and *Type* as above.

The different forms of *Mogera* are chiefly distinguishable by size, and may be most readily understood by forming an index-number from the length multiplied by the breadth of the skull, and then arranging the resulting numbers geographically. It thus appears that the true *wogura*, from Tokyo, Yokohama, and northwards, has index-numbers from 575–600, while there is a broad band of the large *kobeæ* (712–796) ranging from the Oki Islands across Kobe to Shikoku and Owari Bay. Then again westwards in Nagasaki, the Goto Islands, and Yakushima we have the smaller *M. w. kanai*, with index-numbers from 581 to 637, a single skull from Tsu-shima being about the same (642). In the north, according to Nehring's calculated figures, *M. robusta* indexes no less than 936, followed immediately southwards by the present animal, of which the type has an index of 682, the second specimen, from Seoul, being of about the same size.

Just as the largest *Mogera* is found in the north, at Vladivostok, so in the south, in China and Formosa, we find the smallest. *M. insularis* Swinh. from Formosa has index-numbers of 483–496, while the following new species, from China, is still smaller:—

Mogera latouchei, sp. n.

Talpa wogura Thos. P. Z. S. 1898, p. 771.

Size very small, index-numbers of skull 390–406. First upper premolar single-rooted, shorter than p^2 (as in *M. insularis*); brain-case rounded, its outer corners not sharply angular as in the different forms of *M. wogura*. Colour blackish slaty, more as in European Moles, not brown as in *M. wogura*.

Dimensions of type (measured on the spirit-specimen):—

Head and body 96 mm.; tail 16; hind foot 13·5.

Skull: greatest length 29 mm.; basal length 24·2; greatest breadth 14; interorbital breadth 6·8; palatal length 12; front of canine to back of m^3 10·2.

Hab. Kuatun, N.W. Fokien, alt. 3500′.

Type. Adult female in spirit. B.M. No. 98.8.17.1. Collected and presented by Mr. J. de La Touche. Six specimens seen, presented by Messrs. La Touche and C. B. Rickett.

My only excuse for having confused this distinct species with *M. wogura* lies in the fact that at the date my paper was written hardly any specimens of true *wogura* were available for examination, a state of things now materially altered by the assistance, first of Mr. R. Gordon Smith in Japan, and then by the results of the Duke of Bedford's Exploration in the various localities concerned.

In doing his palæontological work Dr. Forsyth Major had already noticed the peculiarities of this Mole, but has not found time to describe it, and now wishes me to do so.

4. Felis microtis M.-Edw.

745, 746. Skins purchased at Taiku.

5. Nyctereutes procyonoides Gray.

1197. Skin purchased at Fusan.

6. Putorius sibiricus Pall.

♂. 1162. Chong-ju, 68 miles S. of Seoul, 500′.

7. Sciurus vulgaris L.

♂. 1152. ♀. 1151. Kaloguai, 55 miles N.E. of Seoul, 500′.

Apparently subsp. *calotus* Hodgs., but more material is needed before the exact relationship to each other of *calotus*, *orientis*, and *rupestris* can be made out.

Since writing the description of the Saghalien subspecies *rupestris* *, on summer skins, I have found a winter example of the same form among some Siberian Squirrels received in 1897 from the St. Petersburg Museum. This specimen is a clear grey, without any trace of the rufous suffusion on the back so marked in the Hokkaido Squirrel *S. v. orientis*.

8. Sciuropterus aluco, sp. n.

♀. 1148. Kaloguai, 55 miles N.E. of Seoul, 500′, 25th Nov., 1906. B.M. No. 7.6.3.18. *Type*.

More buffy than *S. russicus*, paler than *S. momonga*. Teeth very small.

Size rather less than in *S. russicus* and *S. momonga amygdali*, greater than in the true *S. momonga*. General colour pale buffy drab, not so strong as in *momonga* nor of such a clear grey as in *russicus*. Upper surface of hands and feet grey, the light hairs

* *Supra*, p. 410.

on the toes cream-colour, more extended proximally than in the allied forms. Tail pinkish buff, the intermixed black hairs of the upper layer unusually few in number, and therefore not hiding the buff.

Skull with a narrow, parallel-sided muzzle, less expanded anteriorly than in *S. russicus*. Palatal foramina rather long. Bullæ slightly larger than in *momonga*, decidedly smaller than in *russicus*. Incisors unusually dark orange in front. Cheek-teeth very small, as narrow as in the much smaller true *momonga*.

Dimensions of the type (measured in the flesh):—

Head and body 157 mm.; tail 149; hind foot 35; ear 19·5.

Skull: greatest length 39 mm.; basilar length 29·5; greatest breadth 23; nasals 12·2 × 5·1; interorbital breadth 7·5; breadth of brain-case 17; palatilar length 16·2; palatal foramina 5·5; length of bulla 10·2; length of upper tooth-series exclusive of p^3 6·5; greatest breadth of m^1 1·8.

Hab. and *Type* as above.

This Korean Flying-Squirrel is in many ways intermediate between *S. russicus* and *S. momonga*, and perhaps indicates that the latter should be looked upon as one of several Far Eastern subspecies of the former. In the meantime I give it a binomial name in order not to prejudge the question before ampler material is available. As a nameable form, whether species or subspecies, *aluco* may be distinguished by its intermediate colour, buffy tail, short feet, and small teeth.

9. TAMIAS ORIENTALIS Bonh.

♂. 1134. ♀. 1139, 1141, 1142. Kim-hoa, 65 miles N. of Seoul, 300′.

♀. 1147. Kaloguai, 55 miles N.E. of Seoul, 500′.

The male 1134 is the only adult specimen, the others being all about three-fourths grown.

10. MICROMYS SPECIOSUS PENINSULÆ Thos.

♂. 1136. Kim-hoa, 65 miles N.E. of Seoul.

♂. 1185, 1191. ♀. 1184, 1186. Chong-ju, Chung-Chong, 500′ and 800′.

11. MICROMYS AGRARIUS MANTCHURICUS Thos.

♂. 1125, 1127, 1129. ♀. 1126, 1130. Penchan, 50 miles N.E. of Seoul, 300′.

♂. 1150. Kaloguai, 55 miles N.E. of Seoul, 500′.

♀. 1132. 65 miles N.E. of Seoul, 300′.

♂. 1155, 1157, 1158, 1159, 1164, 1165. ♀. 1156, 1161. Chong-ju, 68 miles S. of Seoul, 500′.

♂. 1170, 1173, 1178, 1188. ♀. 1171, 1172, 1179, 1189, 1190. Near Chong-ju, 800′.

The variation in the development of the dorsal stripe is as great in these as in the South Korean series. Specimen No. 1150 has practically no stripe at all, others have it very faint, while in the majority it is well developed. In No. 1126 it even begins on the forehead close to the eyes instead of merely on the posterior crown or nape.

12. Cricetulus nestor, sp. n.

♂. 1133, 1140 (young). ♀. 1144. Kim-hoa, 65 miles N.E. of Seoul, 300′.

Allied to, but even larger than, *C. triton* de Wint.

Size largest of the genus, the type with longer foot and longer tooth-row than *C. triton*, hitherto by far the largest known species. Fur close and fine; wool-hairs of back about 11 mm. in length, the longer hairs surpassing them by 3 or 4 mm. General colour above between "smoke-grey" and "drab-grey" of Ridgway, without the buffy or clay-coloured tone of *C. triton*. Under surface greyish white, not sharply defined, the slaty bases of the hairs shewing below their white tips. Head like body; eyes with a narrow darker rim. Ears with proectote black, rim whitish, the remainder brown. Upper surface of hands and feet white; posterior half of soles hairy. Tail long, as in *C. triton*, the basal $\frac{1}{2}$–$\frac{3}{4}$ inch grey and furry like the body, the remainder finely haired, brown above, greyish white below.

Skull very similar to that of *C. triton*. Supraorbital edges evenly divergent, sharply square, no doubt slightly beaded in older specimens. Palatal foramina long, reaching back nearly to the level of the front of m^1. Mesopterygoid fossa broader than in *C. triton*.

Dimensions of the type (measured in the flesh):—

Head and body 127 mm.; tail 71; hind foot 24; ear 17·5.

Skull: greatest length 33·6 mm.; basilar length 28·5; greatest breadth 17; interorbital breadth 5·2; palatilar length 15; diastema 10; palatal foramina 7·3; length of upper molar series 5·6.

Type. Young adult female. B.M. No. 7.6.3.52. Original number 1144. Collected 19th November, 1906.

This species is no doubt nearly allied to the *C. triton* of Shantung, but differs in its greyer colour and larger size. The oldest specimen, the type, is itself barely adult, but the longer tooth-row and hind foot show that old specimens would considerably exceed in size the type of *C. triton*, which is an aged individual.

13. Craseomys regulus Thos.

♂. 1135. Kim-hoa, 65 miles N.E. of Seoul, 300′.

♂. 1149. Kaloguai, 55 miles N.E. of Seoul, 500′.

♂. 1169, 1176, 1181. ♀. 1168, 1177, 1182, 1187, 1192, 1194, 1195. Near Chong-ju, Chung-Chong Province, S. of Seoul, 800′.

May 28, 1907.

Dr. J. Rose Bradford, F.R.S., Vice-President, in the Chair.

The Secretary read the following report on the additions that had been made to the Society's Menagerie during the month of April 1907:—

The number of registered additions to the Society's Menagerie during the month of April was 284. Of these 116 were acquired by presentation and 66 by purchase, 45 were received on deposit, 48 by exchange, and 9 were born in the Gardens. The number of departures during the same period, by death and removals, was 158.

Among the additions special attention may be directed to:—

A Hoolock Gibbon (*Hylobates hoolock*) from Rangoon, presented by Mr. A. H. E. Wood, F.Z.S., on April 29th.

A Golden Cat (*Felis temmincki*) from Padang, Sumatra, purchased on April 3rd.

A Collection of Mammalia from Ceylon and Singapore, including a White-whiskered Palm-Civet (*Paradoxurus leucomystax*) and a Malayan Tapir (*Tapirus indicus*), presented by Mr. W. E. Balston, F.Z.S., on April 15th.

Two pairs of Mithan or Gayals (*Bibos frontalis*) from Sikkim, deposited on April 18th.

A pair of Chamois (*Rupicapra tragus*) from the Austrian Tyrol, received in exchange on April 22nd.

A pair of Owen's Kangaroos (*Macropus magnus*) from Australia, deposited on April 29th.

Two Little Sparrow-Hawks (*Accipiter minullus*), a One-streaked Hawk (*Melierax monogrammicus*), a Grey Eagle-Owl (*Bubo cinerascens*), and a Fraser's Eagle-Owl (*Bubo poensis*) from Lagos, presented by Dr. Macfarlane, F.Z.S.

The Secretary exhibited a specimen of the patent Falconnier Glass Bricks, which had been referred to by Mr. Trevor-Battye at the last scientific meeting of the Society, as specially suitable for the construction of menagerie buildings.

The Secretary also exhibited the frontlet with horns of a specimen of the Tákin, *Budorcas taxicolor* Hodgson, and made the following remarks:—

These fine horns have been lent to me by Mr. A. St. Clair Carnegy, to whom they were given by Mr. Charles T. Forbes of Badipar, Assam, the latter having obtained them from the Rajah of the Kampti Country.

The tips of the horns bend in towards the middle line rather more than in other examples I have seen. The actual distance between the tips is 9½ inches, whereas in the instances quoted in Mr. Rowland Ward's 'Records of Big Game' (5th Edition) the measurements range from 10 to 15 inches. On the other hand, the length along the front curve is $22\frac{1}{2}$ inches, which places the specimen an equal fourth in the 'Records,' whilst the circumference is 12 inches, against a range of 11 to 13 inches in the same 'Records.'

Hodgson, who originally described *Budorcas* (Journ. As. Soc. Bengal, 1850, p. 65), thought its nearest affinity was with the Gnus, but that in a natural system its place would probably be assigned between these and the Musk Oxen.

Matschie (Sitz-Ber. Gesells. Naturf. Berlin, 1896, p. 30) carried further the suggestion of the affinity with the Musk-Ox, although he appears to have overlooked that Hodgson originally had made it, and made a group Ovibovinæ, for *Budorcas* and *Ovibos*, relying chiefly on the form of the metacarpus, the skull and horns, and certain external features. In one curious point not mentioned by him, the resemblance with *Ovibos* is striking. In the majority of Ruminants, the proximal ends of the nasal bones are closely approximated, forming a pointed, or rounded projection into the frontal area. In *Budorcas* and *Ovibos*, on the other hand, the proximal end of each nasal is triangular, and a triangular projection of the conjoined frontals fits deeply between them. I have seen a slight approach to this condition in the Gnu and in one specimen of Goral, whilst there are traces of it in some of Rütimeyer's figures of extinct Ruminants, but it is a rare condition. On the other hand, *Budorcas* differs markedly from *Ovibos* and the Gnus and resembles the Goral in the condition of the nasal process of the maxilla. Thus in *Ovibos*, Cattle, and the Gnu, the latter has a broad articulation with the nasal, whilst in *Budorcas* and the Goral a wide cleft separates the nasal and maxilla, the latter only just touching the nasal at the distal edge of the nasal-lacrymal articulation. The lacrymal has a definite articulation with the nasal in *Budorcas*: the two are separated by a wormian bone in all the specimens of *Ovibos* I have seen. In the Goral, the condition is like that in *Budorcas*, whilst in the Gnu the lacrymal reaches the nasal only by a narrow point, if at all.

Dr. H. Hammond Smith exhibited a collection of the grits from the gizzards of Game-birds, and made the following remarks:—

The collection of the grits from the gizzards of the Game-birds of England, Scotland, and Wales, that I have got together, is the result of some work I have done for the Grouse Disease Enquiry Committee. Mr. R. H. Rastall, M.A., F.Z.S., of Christ's College, Cambridge, kindly examined, and has reported on, the petrological nature of the stones.

Naturally I began with the Grouse, but that led me to examine the gizzards of other game-birds, and I have now specimens taken from all the game-birds of Britain, excluding Ireland.

Ptarmigan.—I have only two specimens of the Ptarmigan, obtained late in the season from Ben Mohr in Sutherlandshire;

these show the usual quartz and quartzite, and, curiously, one contained a shot.

Grouse.—There are 17 specimens of Grouse, from Ross-shire, Inverness-shire, Aberdeenshire, and North Wales. In the Scotch birds quartz preponderates, with feldspar-granite, and garnets; in the Welsh birds the grit is mainly quartz, chiefly derived from vein-quartz. (The latter quartz is also found in birds lately examined in Kincardineshire.) Of these birds five contained shot, and in one from North Wales a No. 8 shot was found, pointing to the fact that the shot are swallowed, as few people shoot grouse with No. 8. In no case was there any sign of a wound of the the gizzard.

Black Game.—Only 5 specimens; four of these are from Ross-shire, and one from Exmoor; practically they all contain quartz, and the Ross-shire birds contain also pebbles from the igneous rocks. One contained three shot.

Pheasants.—47 specimens. These include specimens from the moorlands of Ross-shire, Inverness-shire, North Wales, and Exmoor; birds from Worcestershire, Bedfordshire, Buckinghamshire, and from the chalk land of Hampshire; and birds from Surrey, Norfolk, and Middlesex. Naturally these vary very much in the character of the grit, but in 22 more or less quartz was seen.

Some of the Scotch birds were obtained for me by Lord Lovat and Mr. Munro Ferguson of Novar from the moors of Inverness and Ross-shire, and the grit found in them is almost the same as that found in the Grouse; the same obtains with birds shot on Exmoor, which contain grit very similar to the Scotch birds and the birds killed in North Wales by Sir Watkyn Wynn. But the Pheasant up to a certain point seems to be able to adapt itself to the grit it finds in certain localities, provided it is hard enough. This is well shown in a bird from Kerry Abermule, N. Wales, which evidently had been feeding on wild rose berries; only five pebbles were found in the gizzard, the seeds of the rose berries evidently acting as grit, as happened in some other cases.

The adaptability of the Pheasant to its surroundings was well shown in the case of a bird from Uxbridge, 13 miles from London, in which the contents of the gizzard included pottery-ware. Mr. Rastall in his report showed that three birds, shot at Horley in Surrey on the same day, contained a remarkably different collection of grits. They were obtained in a circumscribed area, highly preserved, but I have been unable to find out whether grit was artificially supplied or not.

One set of specimens is very interesting as showing that the Pheasant, when preserved, must have proper grit. These specimens were sent from a wood in Worcestershire—Bissell Wood near Stourbridge, noted for not holding Pheasants. Last season 500 Pheasants were put into the wood, and only 100 were shot. The gizzards contained pebbles which Mr. Rastall is unable to identify as being found in Old or New Red Sandstone, but knowing the county, I can say they probably came from the New Red Sandstone.

In every other respect this wood is an ideal one for Pheasants, but it would appear that the grit was not hard enough for them, and they would not stay in it.

It is curious that in all these 47 gizzards, and in many more that I examined, I found only one shot, while amongst the Grouse I found 1 in every 3.

Partridges.—I am exceedingly sorry that I did not begin to examine Partridges till too late in the season to get more specimens than I did. I examined only 11 gizzards from Ross-shire, N. Wales, Middlesex, Norfolk, and Essex. But these give the most surprising results I have yet obtained, for in every specimen the proponderating grit is quartz. Mr. Rastall makes a note: "Owing to the small size of the individual grains in the Partridges, it is impossible to work them out in such detail as in the case of the other species, but I have been unable to detect any real difference, except in size, between the different species of bird in the same locality." Where do the Essex, Norfolk, and Middlesex Partridges get their quartz from? But they do get it, and it is difficult to tell the grit found in the gizzard of a Middlesex Partridge from that found in the gizzard of a Scotch one from Ross-shire, except that in the latter you might find a garnet or two; I have one in this collection containing 11 garnets.

I was able the other day in Scotland to find out at what an early age the game chick begins to pick up grit; for on examining the gizzard of a grouse chick two days old I found quartz.

It is common knowledge that birds kept in captivity require grit to keep them in health, but it is most important to know what is the best grit for them: personally I think the game-birds prefer quartz; the next most common stone is flint, 16 of my specimens containing this stone.

A paper by Dr. G. Elliot Smith, of the School of Medicine, Cairo, entitled "On the Form of the Brain in the extinct Lemurs of Madagascar, with some remarks on the affinities of the *Indrisinæ*," was read. It formed a supplement to the paper on recently-discovered subfossil Prosimiæ from Madagascar, read before the Society by Mr. H. F. Standing on March 19th. From an examination of cranial casts of an extinct species of Lemur and of *Mesopropithecus* and *Palæopropithecus*, and of brain-casts of *Nesopithecus* and *Megaladapis*, in conjunction with information derived from the study of recent Lemurs, the Author had arrived at the conclusion that *Propithecus*, *Avahis*, *Indris*, *Mesopropithecus*, *Nesopithecus*, *Palæopropithecus*, *Chiromys*, and *Megaladapis* must be regarded as the diversely specialised members of one family, all of which exhibited in greater or less degree distinct evidence of retrogressive changes from a more primitive and also more pithecoid type.

This paper will be published entire in the 'Transactions.'

The following papers were read:—

1. On the Abdominal Viscera and a Vestigial Seventh Branchial Arch in *Chlamydoselachus*. By Mrs. O. A. Merritt Hawkes, M.Sc. (Zoological Laboratory, University of Birmingham).*

[Received March 23, 1907.]

(Text-figures 138, 139.)

Introduction.

The following notes on the abdominal viscera of *Chlamydoselachus anguineus* (Gar.) are published, because the first writer on this species, Garman (**1**), had only a partly eviscerated female, and the second writer, Günther (**2**), gave only a general description which does not make note of the distinctive characteristics of *Chlamydoselachus*. On some points, my specimens did not agree with either that of Garman or those of Günther.

As the heart has already been described by both Günther and Garman, it has not been necessary to make any further reference to that organ.

In this paper, an attempt has been made to look upon the alimentary viscera from the functional as well as the anatomical point of view, hence suggestions have been made to attempt to explain certain Chlamydoselachian peculiarities.

Garman has given a description and a figure of the branchial arches, but in his specimen there was obviously no trace of the vestigial seventh arch. It is probable that this arch and its nerve-supply † are of a very variable character, as is frequently the case with vestigial structures.

The Alimentary Canal.

The general arrangement of the alimentary canal in *Chlamydoselachus* is, in most of its features, typically Elasmobranchian.

There are thirteen rows of teeth on each side of the upper and lower jaws, making a total of 52 rows, instead of 51 as stated by Garman (**1**). The arrangement is, as would be expected, bilaterally symmetrical. In every specimen examined, however, there was a torsion of the left front row of teeth towards the right side; and in one case this resulted in a median row of teeth as described by Garman, but the total number of rows of teeth was still 52.

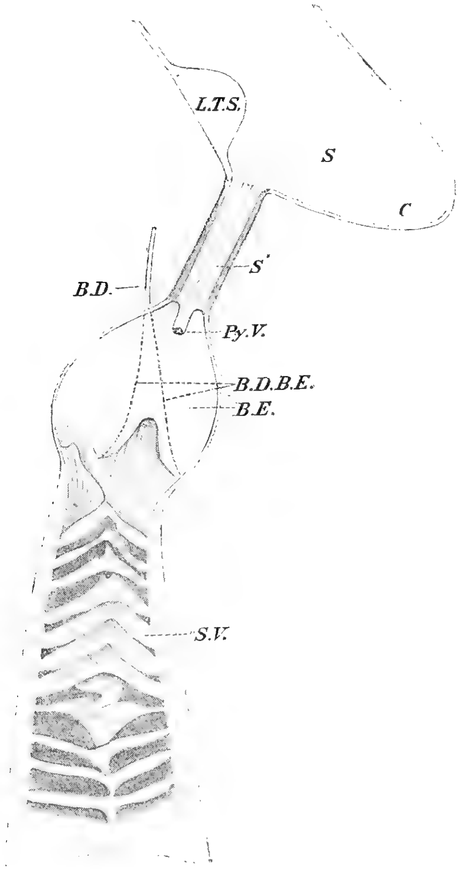
Garman found six functional teeth in each row, but the specimens examined by me had generally five, although in some cases six.

* Communicated by Professor Bridge, F.Z.S.

† See Proc. Zool. Soc. 1906, p. 983.

The mouth is succeeded by the pharynx into which open the six pairs of branchial clefts, the first of which is 1 cm. longer than

Text-fig. 138.



Alimentary canal from the middle of the stomach to the middle of the colon of *Chlamydoselachus*.

Reference Letters.

B.D. Bile-duct.
B.D.B.E. Dotted lines showing the position of the apparently enlarged end of the bile-duct in the walls of the bursa entiana.
B.E. Bursa entiana.
C. Cæcum at the hinder end of the larger arm of the stomach.
L.T.S. Thickening of the stomach wall, probably due to a lymphatic gland.
Py.V. Pyloric valve.
S. Stomach.
S′. Short arm of the stomach.
S.V. Spiral valve.

the others. A wide and very distensible œsophagus follows, and this passes without any external mark of differentiation into the stomach. This organ is U-shaped, one arm being much longer than the other, which is, at first sight, scarcely noticeable. The longer arm of the stomach (text-fig. 138, S) ends in a small cæcum (C). Opposite the cæcum, the stomach-wall is thickened, perhaps by a lymphatic gland (L.T.S.). This thickening, on account of its position, would probably function as a valve between the two arms of the stomach. The walls of the stomach are irregularly corrugated. The shorter arm of the stomach (S′) differs from the larger anatomically and functionally. It is a short, thick-walled tube incapable of distension, the lining mucosa of which is raised into parallel ridges. This arm opens into the intestine by a protruding pyloric aperture (Py. V.) which is furnished with distinct sphincter muscles. The relatively narrow lumen of the shorter arm of the stomach, combined with the action of the pyloric sphincter, acts as an efficient guard against the passage of large pieces of partly digested food into the colon. Anything but a semi-liquid chyle might produce a serious obstruction in the course of the long and complicated spiral valve.

The bile-duct (B.D), which traverses the anterior division of the spleen, becomes joined to the anterior part of the "bursa entiana" (B.E). It then rapidly enlarges, and finally opens into the bursa by an aperture the diameter of which equals the semi-diameter of the latter. The terminal third of the duct has its lining mucosa raised into parallel striæ which are continuous with those seen in the first part of the colon. This suggests that the region which appears to be the terminal portion of the bile-duct is, in reality, an evagination of the colon towards the bile-duct. Owing to the presence of the striæ, the bile must pass backwards towards the spiral valve and not forwards into the bursa entiana. The bursa, which is a thin-walled sac, may serve as a distensible receptacle for the partly digested food before it is passed on in small quantities into the comparatively inelastic colon. The pancreatic duct opens into the region where the spiral valve begins; hence, although gastric digestion may continue in the bursa, intestinal digestion cannot begin until the food reaches the spiral valve. The so-called colon has thick walls. Its shape is that of a double cone, the widest part varying in position, but in both of my specimens it was near the region of the contorted coil. The widest part has the thickest walls. In the specimen examined the spiral valve had 43 coils (text-fig. 138). The valve at the very beginning is a well developed ridge, but at the end it tails off gradually. In the specimen figured by Günther (2) there were only 35 turns, whilst the valve both began and ended gradually. In both Günther's specimen and that under discussion, the anterior cone-like coils pass forwards, the posterior backwards. Both specimens have an intermediate region of one coil in which the valve is contorted. Of the 35 coils in Günther's specimen 19 pass forward, one is contorted, and 15 pass backwards; of the 43 coils in my specimen

7 pass forward, 1 is contorted, and 35 are directed backwards. In all the species of Elasmobranchs which Parker (**3**) described there was a much smaller number of coils which were either directed forwards or backwards continuously. He states, however (p. 49), that " in a smaller specimen of the same species (*Scyllium canicula*), there were 8 turns to the valve, of which 5 had a forward and the last 3 a backward direction." This condition was exceptional in the species named. It is not improbable that the twofold direction of the valves in *Chlamydoselachus* has some physical relation to the large number of coils. It can have no relation to the length of the colon, as this is not relatively longer than in the majority of Elasmobranchs. On the other hand, the twofold direction may have a special physiological significance. Where the valves are directed forward, the passage of the food is undoubtedly slower than where they are directed backwards.

In *Chlamydoselachus* the coils of the spiral valve are closer to one another, and the valve is broader, in the anterior than in the posterior region. The anterior valves are covered by numerous well-defined striæ. The valve reaches a breadth of three-fourths of the diameter of the colon in the anterior region, which is, *par excellence*, the region of intestinal digestion. Owing to the anterior direction of the valves, the movement of the food is slow, and it is further hindered by the contorted coil which divides the colon into two physiological parts. Absorption takes place in the posterior part where the valves are directed backwards, and where there is comparative rapidity of movement. In this region, the striæ are absent, except on the first 7 coils where they are few and inconspicuous.

The spleen is interesting in that it is divided into two parts which are separated by a space of 4 cm. The additional lobe is situated to the right of the stomach and somewhat dorsally. It is an ovoid body, 3 cm. long and nearly 2 cm. broad in the widest part, and is situated between the stomach and a fold of mesentery which supports the latter. The other part or spleen proper lies in the usual place at the angle of the stomach. The histological characters of the spleen proper when examined by a low-power lens present the usual appearace, but the structure of the additional lobe is much more compact.

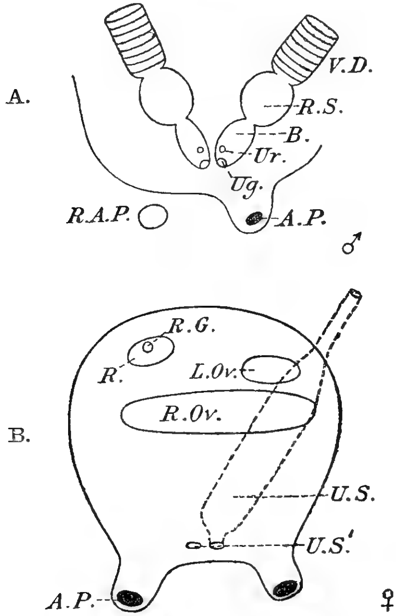
The rectum has thin and much wrinkled walls. Its diameter is slightly greater than that of the adjacent portion of the colon. The rectal gland opens into the rectum in the mid-dorsal line, 1·5 cm. beyond the end of the colon. According to Günther the gland opens into the cloaca, but it certainly did not do so in the two specimens examined by me.

The liver consists of right, left, and median lobes. The gall-bladder is situated in the median lobe. The length of the lobes necessitates their being doubled forward upon themselves. In one specimen, the end of the left lobe was lying on the right side of the body-cavity.

The Urogenital Organs.

The Female.—The ovaries are diffuse bodies attached by broad mesenteries to the line of attachment of the " stomach " mesentery. The right ovary is placed somewhat more anteriorly than the left. The oviducts have large funnels which open ventrad to the stomach, instead of dorsad as is usually the case. The edges of the funnels are irregular and spreading, and are united in the median ventral line to one another, thus forming one large funnel. The anterior edges of the funnels become united to the anterior wall of the body-cavity, whilst the posterior edges of the united fimbriæ hang free. A triangular dorsal pouch is thus made between the wall of the abdominal cavity and the funnel. As this pouch is in the usual position of the cœlomic openings of the oviduct, the eggs would tend to pass into it instead of into the latter, if this were not prevented by the unusual position of the ovaries which are ventral to the oviducts. For the first 6 cm. the oviduct is a straight tube, the walls of which are lined with numerous laminæ. This region passes into the oviducal gland, the walls of which are much thickened, except along two longitudinal lines which are approximately dorsal and ventral. The length of the gland is 3 cm. Its interior is covered by fine laminæ *continuous* with those in the preceding and succeeding portions of the oviduct. The laminæ run spirally, and are very close together, instead of longitudinally and somewhat separated, as is the case throughout the remainder of the oviduct. The transverse deeper groove in the oviducal gland mentioned by Garman (**1.** p. 20) was found in the specimen examined. Passing from the oviducal glands, the oviducts regain their original diameter, but the walls are smoother, the laminæ being reduced to slight striæ. When the oviduct reaches the level of the anterior end of the colon, it enlarges. The enlargement is gradual and only increased in diameter about fourfold on the left side, but on the right the enlargement is sudden and very apparent, the diameter increasing 14 to 15 times. This region in addition to being enlarged has folded walls, in which occur one large and several small areas of dilated blood-vessels. The largest blood-plexus occupies about one-third of the right side of the oviduct. In connection with each plexus, on its dorsal side, the oviducal wall is thickened over an area which equals the plexus in length and breadth. The enlarged vessels apparently supplied these thickened areas. The condition of the oviduct thus described suggests that this portion of the oviduct acts as a functional uterus, and that therefore *Chlamydoselachus* produces the young alive, as suggested by Garman. The final portion of the oviduct, which succeeds the uterine, has smooth walls and a large diameter, the latter gradually diminishing towards the cloaca. This region divides the functional uterus from the cloaca, thus functionally representing the vagina of higher types. The opening of the right enlarged oviduct (text-fig. 139, R.Ov.) has acquired a median position, the left oviducal opening (L.Ov.) lying cephalad to it. Garman also found that one oviduct was much enlarged but does not mention which, but from his drawing (**1**. pl. xix. fig. 2) it appears to have been the right. Günther does not mention the female reproductive organs.

Text-fig. 139.



Diagrammatic figures of (**A**) male and (**B**) female cloaca of *Chlamydoselachus*.

Reference Letters.

A.P. Closed abdominal pores.
B. So-called "bladder" (urinary sinus).
L.Ov. Left oviducal opening.
R. Rectum.
R.A.P. Functional right abdominal pore.
R.G. Opening of rectal gland into rectum.
R.Ov. Right oviducal opening.
R.S. Seminal vesicle.
Ug. Urinogenital opening.
Ur. Opening of ureter into urinary sinus (B).
U.S. Urinary sinus of female.
U.S′. Openings of urinary sinuses into the cloaca.
V.D. Vas deferens.

Transverse sections through the thickened areas of the uterus show that the lining membrane is much folded and is entirely covered by a columnar epithelium, the cells of which have a distinctly granular appearance. It is impossible to state definitely whether any glands homologous with uterine glands of higher forms are present, but it is highly probable that all the granular columnar cells secrete a fluid. The musculo-fibrous tissue of the uterine wall is greatly thickened owing to an increase of connective tissue in which connective-tissue corpuscles abound *.

The kidney in the female is thin dorso-ventrally and of irregular breadth. It extends from the region of the oviducal gland to the end of the body-cavity, gradually widening as it passes backwards in a sinuous line. The sinuosity is due to the arrangement of some of the dorsal muscles. Cephalad to the kidney and apparently unconnected with it, there is an irregular body (1·5 cm.) which extends somewhat beyond the end of the abdominal cavity. This is probably the head kidney (pronephros?), which in the adult has retained its position in the region to which the cœlom extended in the embryo.

There are two very small cloacal apertures for the urinary sinuses (text-fig. 139 B, U.S′.) in the specimen examined, although Garman only found one in his (**1.** p. 20). They are situated in the median line near the external opening of the cloaca. The openings are near together but can hardly be mistaken for one. Each aperture passes into an expanded chamber (U.S.) with laminated walls, the lumen of which has a diameter of 5 mm. in the cloacal region. The first portion of the sinus is embedded in the thick cloacal walls. Each sinus extends forwards for a distance of 6 cm. beyond the cloaca along the inner side of the kidney, but in front of this point it lies near the oviduct, at a distance from the kidney varying from 1 to 2 cm. The same mesentery which supports the oviduct also supports the urinary sinus and the mesonephric ducts. The latter pass from the kidney at regular distances, there being approximately one to each myotome.

In the female cloaca the rectal aperture is displaced to the right, and the same deviation, but to a much less degree, occurs also in the male.

The Male.—In the male there are two urogenital apertures (text-fig. 139 A, Ug.), each of which is the outlet of an oval urogenital sinus (B.), which Günther described as a urinary bladder. The sinus communicates by a very small aperture with a second and larger chamber (R.S.), which possibly functions as a seminal vesicle, and in front has opening into it the vas deferens or mesonephric duct (V.D.). The vas deferens has one or more projecting spiral folds, which run from one end of the duct to the other. For the last 10 cm. of the length of the duct the folds were very obvious, but from this point forwards they become almost invisible to the naked eye. The folds are so close together in the

* Since this paper was read, I have received a letter from Mr. Kumakichi Aoki, of the Zoological Station at Miura Misaki, stating, in answer to some questions, that eggs are not laid and that he has lately had two females, each of which contained five embryos, in one case measuring one foot each and in the other one inch. Each very young embryo with its large yolk-sac was surrounded by a gelatinous sac, no doubt the remnant of the egg envelopes.

posterior part of the duct that Günther speaks of an annular lining. The function of the folds, which, in all probability, is to pass along the sperms, and possibly at the same time to unite them into bundles, could scarcely be effective, however, if the folds were annular. The lumen of the left vas deferens, which Günther found to be better developed than the right in one specimen, is very irregular in diameter in my specimen. At its widest the duct is about 5 mm., but where narrowest it only allows the passage of a bristle.

One of the males examined has two abdominal pores (text-fig. 139 A, A.P., R.A.P.), of which the right is the better developed. This condition differs from that described by Günther (**2.** p. 4), in which the left pore only was present.

A Vestigial Seventh Branchial Arch.

Three specimens were dissected to determine if there were any trace of a seventh arch. Traces were found in two of the specimens, one of which was not quite full-grown.

The remnants in the smaller specimen consist of four small pieces of cartilage on one side and two on the other. These lie close to the cerato-branchial of the sixth arch, on the posterior side, nearer its median extremity. In the adult specimen in a similar position there are two pieces, the larger of which equalled in length the combined four pieces found in the smaller specimen.

Bibliography.

1. GARMAN, S.—"*Chlamydoselachus anguineus* (Gar.)—a Living Species of Cladodont Shark." Bull. Mus. Comp. Zool. vol. xii. no. 1. p. 1. 1885.
2. GÜNTHER, A.—*Chlamydoselache anguinea.* 'Challenger' Reports, vol. xxii. 1887, p. 2.
3. PARKER, T. J.—"On the Intestinal Spiral Valve in the Genus *Raia.*" Proc. Zool. Soc. 1880, p. 49.

2. Second Report on the Batrachians and Reptiles collected in South Africa by Mr. C. H. B. Grant, and presented to the British Museum by Mr. C. D. Rudd. By G. A. BOULENGER, F.R.S., V.P.Z.S.

[Received May 3, 1907.]

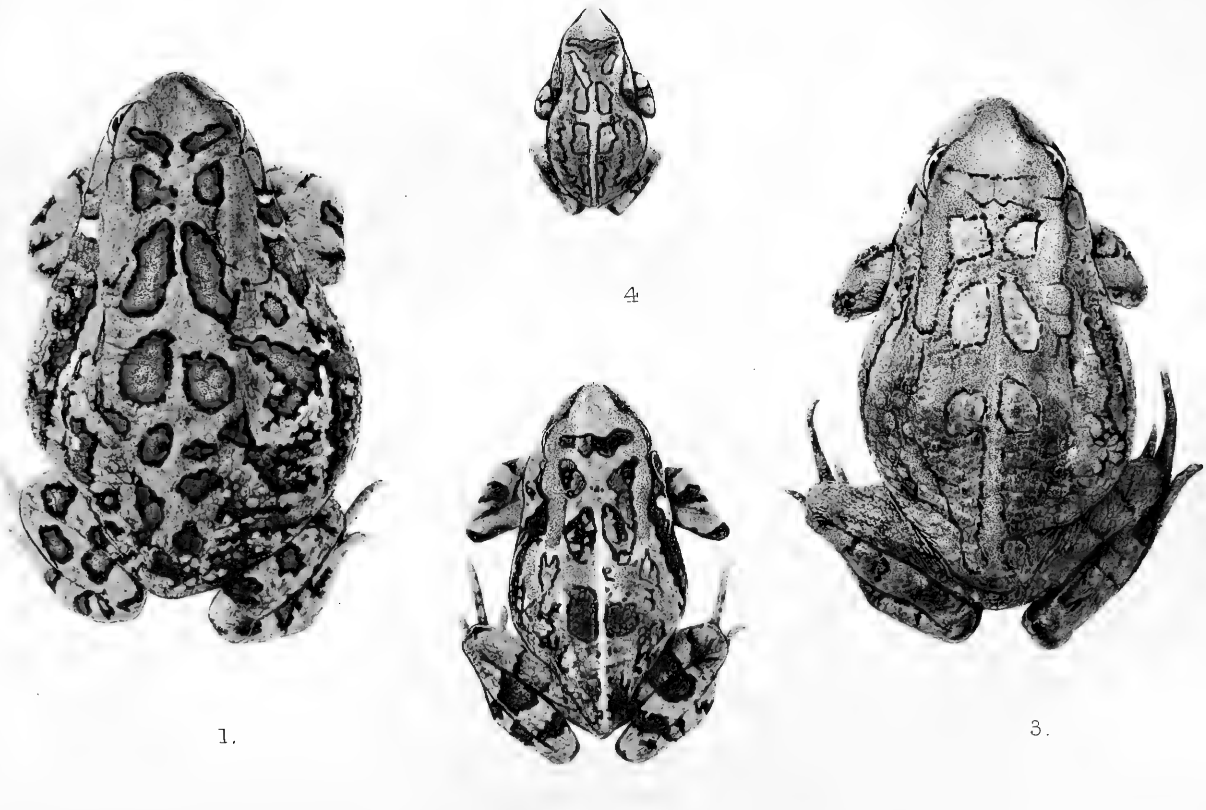
(Plates XXI. & XXII.* and Text-figures 140, 141.)

Since the publication in these 'Proceedings,' two years ago (P. Z. S. 1905, ii. p. 248), of an annotated list of the Batrachians and Reptiles collected by him, Mr. Grant has continued his exertions in the same department, making collections in the following localities:—

I. CAPE COLONY. Knysna, 50 miles east of Mossel Bay.

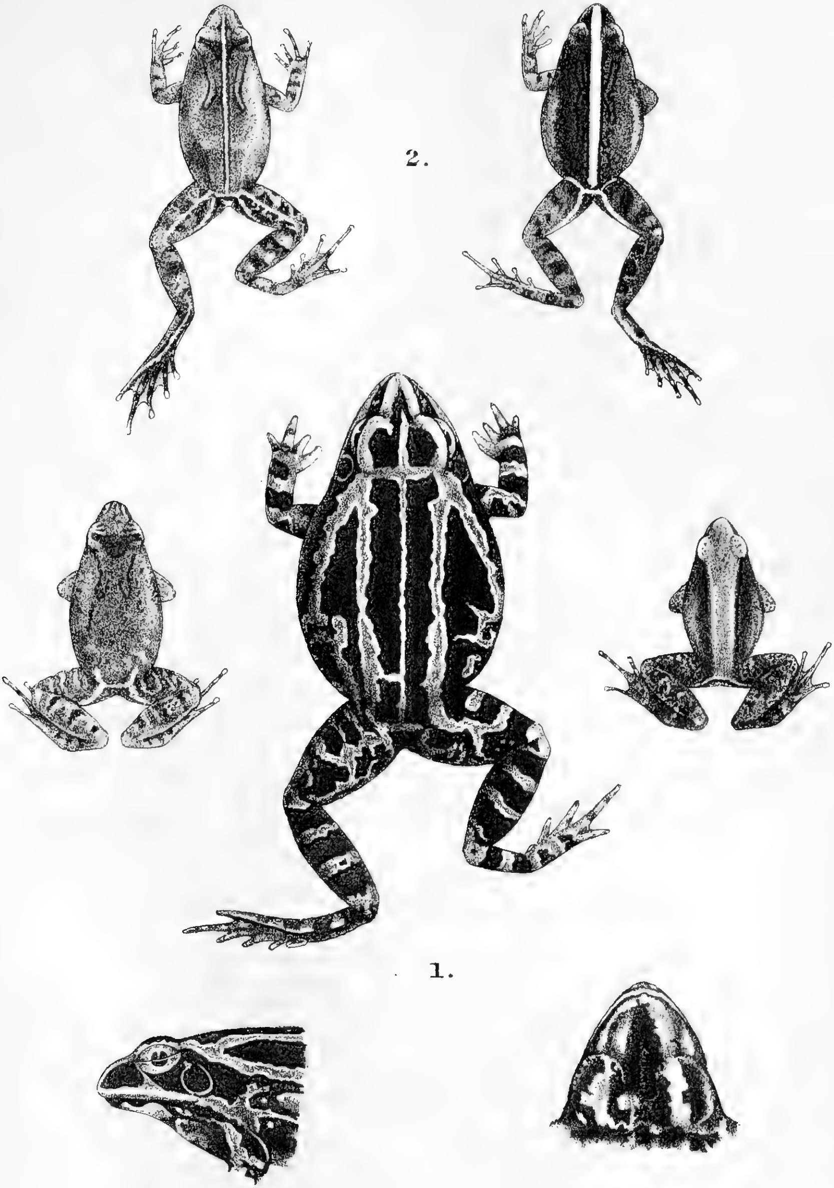
II. NATAL. Illovo, 30 miles S.W. of Durban.

* For explanation of the Plates, see p. 487.



BUFO REGULARIS.

J. Green. Chromo



J. Green del. et lith.

1. RANA RUDDI. 2. PHRYNOBATRACHUS NATALENSIS.

III. Transvaal. Legogot, Barberton District, on Drakensberg Mts., on the Komati R., 2500 feet.
Pietersburg, N. slope of Drakensberg, 2400 feet.
Tuefloop, N. slope of Drakensberg, 18 miles E. of Pietersburg, 4500 feet.
Woodbush, N. slope of Drakensberg, 30 miles N.E. of Pietersburg, 4500 feet.
Zoutspansburg, on Klein Letaba, a branch of Letaba R., affluent of Olifants R., 1000 feet.

IV. Portuguese East Africa. Inhambane.
Coguno, about 80 miles inland of Inhambane.
Beira.

The series of specimens now dealt with proves more interesting than the first, and two species are described as new. In the following list, an asterisk precedes the name of the species not mentioned in the first report *; two asterisks indicate that the species has not been previously recorded from south of the Zambesi.

BATRACHIA.

Aglossa.

1. Xenopus lævis Daud.

Knysna.

Phaneroglossa.

2. Bufo regularis Reuss. (Plate XXI.)

Woodbush, Klein Letaba, Coguno, Beira.

As in almost every part of Africa, this species varies wonderfully in colour and markings, even in specimens obtained from the same pools, where they congregate for breeding. Some have much crimson or pink on the back of the thighs and in the groin, whilst others are entirely deprived of the brilliant colour. The most remarkable specimens are from Woodbush, and might be well thought to indicate a distinct species, were they not connected with the more typical form by every possible gradation. The young have the upper surface of the snout as far back as a dark interocular bar, and the parotoid glands, of a beautiful pink; part of the back is also pink, with grey markings with a fine black border; the pink ground-colour appears as a dagger-shaped marking on the back. These markings become more indistinct with age, and the pink colour gradually fades away or disappears entirely. By a curious inversion of the ground-colour and the markings, some out of a number of specimens from Zoutspansburg are grey with pink markings. Four of these remarkable specimens are figured on Pl. XXI.†

In some of the specimens from Beira, the parotoid glands are exceptionally so flat as to be hardly distinguishable.

* P. Z. S. 1905, vol. ii. p. 248.

† See the two bottom figures on colour-plate vi. of Miss Dickerson's 'Frog Book' for a similar inversion of colour in *Hyla versicolor*.

*3. Bufo carens A. Smith.

Legogot, Woodbush, Coguno.

Specimens from Port Elizabeth, which I have kept alive, were of an olive colour, with the lateral fold, the larger warts, and the loreal region brick-red; iris golden, much obscured by black vermiculations.

**4. Bufo taitanus Peters.

Beira.

This little Toad, remarkable for the absence of the tympanum and the eustachian tubes, was only known from Somaliland, Taita, and the east coast of Lake Tanganyika.

*5. Phrynomantis bifasciata A. Smith.

Beira.

*6. Breviceps verrucosus Rapp.

Knysna.

*7. Breviceps mossambicus Peters.

Zoutspansburg.

*8. Hemisus marmoratum Peters.

Beira.

**9. Rana ruddi, sp. n. (Plate XXII. fig. 1.)

Vomerine teeth in two small groups close to the inner borders of the choanæ. Head feebly depressed, as long as broad; snout rounded, feebly projecting beyond the mouth, a little shorter than the orbit; canthus rostralis obtuse; loreal region concave; nostril equally distant from the eye and from the end of the snout; interorbital region narrower than the upper eyelid; tympanum very distinct, a little smaller than the eye. Fingers very short, obtusely pointed, first extending as far as second; toes short, obtuse, one-third webbed; subarticular tubercles of fingers and toes feeble; a large, compressed, very prominent, shovel-shaped inner metatarsal tubercle, at least as long as the inner toe. The tarso-metatarsal articulation reaches the eye. Skin of upper parts with flat smooth warts of unequal size; a very indistinct dorso-lateral fold; lower parts smooth, sides of belly feebly areolate. Dark brown above, with light, yellowish streaks on the head and body, viz., a narrow vertebral line, a broader band from the end of the snout along the canthus rostralis and the outer border of the upper eyelid to above the tympanum, where it bifurcates, the upper branch extending to above the vent, the lower running obliquely to the groin; usually a yellowish bar across the occiput; a yellowish streak along the upper lip; a white oblique line in front of the eye and a white circle round the tympanum; limbs with dark and pale bars; hinder side of thighs yellowish, marbled with black; throat and breast dark brown, or marbled with dark brown, with a Y-shaped white marking on each side; belly white. Male with two external vocal sacs, opening by a slit on each side of the throat.

From snout to vent 48 millim.

Two males and one female, found breeding in a rain-pool at Beira in February.

This species is very closely related to *R. ornata* Peters, from E. Africa, and *R. ornatissima* Bocage, from Angola. It differs from the former in the shorter web between the toes, from the latter in the much smaller size, in the shorter and less pointed snout, and in the shorter hind limbs. The white markings in front of the eye and under the throat are very similar in the three species. Another very close ally of *R. ruddi* is *R. moeruensis* Blgr., from Lake Mweru, which differs in the longer first finger, the longer hind limbs, the very prominent dorso-lateral glandular fold, and the coloration.

10. Rana angolensis Bocage.

Tuefloop.

*11. Rana oxyrhynchus A. Smith.

Zoutspansburg, Coguno, Beira.

12. Rana mascareniensis D. & B.

Beira.

13. Rana grayi A. Smith.

Knysna.

**14. Rana galamensis D. & B.

Beira.

A widely distributed species, known from the Soudan (from west to east), West Africa from the Senegal to the Congo, and Central and East Africa (*R. bravana* Peters †, *R. oubangiensis* Mocquard).

R. galamensis is closely related to the Indian *R. malabarica* D. & B., and surprisingly resembles the Central-American *R. godmani* Gthr. The male has an external vocal sac on each side of the throat and a large flat gland on the front side of the arm (humerus), as in the Burmese *R. granulosa* And., *R. humeralis* Blgr., and *R. oatesi* Blgr.

I avail myself of this opportunity to point out that the Frog named by me *R. elegans*, which had been previously confounded with the West-African *R. albilabris* Hallow., is identical with *R. guentheri* Blgr., and must therefore be erased from the list of African species.

† Specimens of *R. nutti* Blgr. have been erroneously referred to *R. bravana* by Tornier.

15. Phrynobatrachus natalensis A. Smith.

Coguno, Beira.

This widely distributed Frog varies remarkably in its markings. as do the other species of the same genus. A few specimens from Beira are represented on Pl. XXII., figs. 2–5, to illustrate this feature.

** 16. Arthroleptis whytii Blgr.

Beira.

Previously known from British Central Africa.

*17. Rappia marmorata Rapp.

Beira.

*18. Rappia cinctiventris Cope.

Beira.

*19. Cassina senegalensis D. & B.

Illovo.

The single small specimen, a male, has the elongate oval gular disk of *C. senegalensis* and the distinct web at the base of the toes of *C. wealii.* I now feel very doubtful as to the specific validity of *C. wealii.*

REPTILIA.

Chelonia.

1. Homopus areolatus Thunb.

Knysna.

2. Cinixys belliana Gray.

Beira. Several shells of adults and one young in spirit.

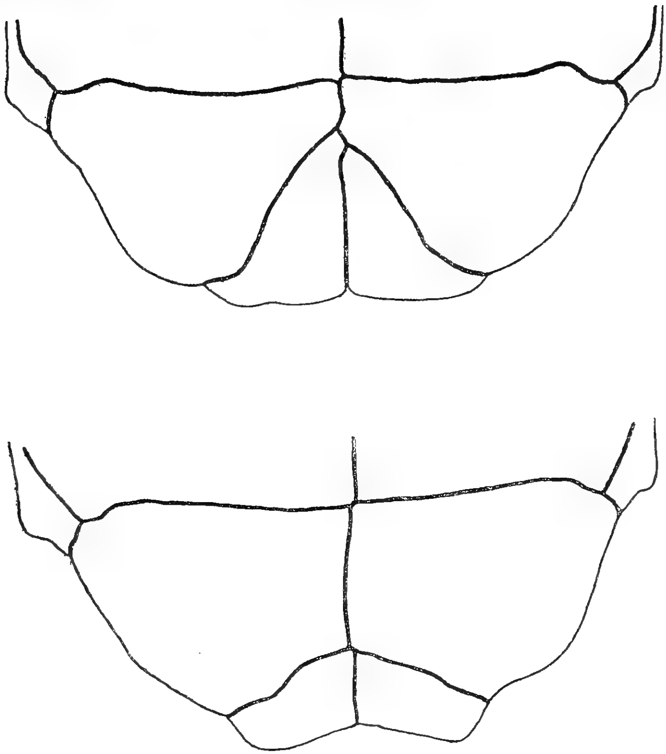
I have previously† taken exception to Dr. Siebenrock's separation‡ of *C. nogueyi* Lataste, as a distinct species, and my view is further confirmed by the series of specimens from Beira. The adults (shells only) have the black radiating streaks on the carapace, and the extent of the suture between the anal shields varies considerably, as may be seen from the annexed figure (text-fig. 140) representing the hind lobe of the plastron in two adult females, showing two extreme types in the series sent by Mr. Grant. Although the fore limb has five claws in the specimens from Mashonaland § and Zululand examined by me, the young from Beira has only four, and would therefore be referable to *C. nogueyi.*

**3. Sternothærus nigricans Donnd.

Beira. Two shells, measuring 110 and 77 millim. respectively.

† Ann. Mus. Genova, xlii. 1906, p. 197.
‡ Sitzb. Ak. Wien, cxii. 1903, p. 442.
§ I now regard *Homopus darlingi* Blgr. as based on a young of this species.

Text-fig. 140.



Hind lobe of plastron in two adult female *Cinixys belliana.*

Suture between the humeral shields shorter than the intergular. These shells agree with my definition of *S. nigricans*† and also with the description and figure of Madagascar specimens given by Siebenrock‡. The same form was obtained in N.W. Rhodesia by Mr. Neave, and is therefore not peculiar to Madagascar, as believed by Siebenrock.

*4. Pelomedusa galeata Schœpff.

Tuefloop.

Lacertilia.

*5. Hemidactylus mabouia Mor.

Zoutspansburg, Coguno, Beira.

† Cat. Chelon. p. 195 (1889).
‡ Schildkröten, in Vœltzkow, Reise Ostafr. ii. p. 36, pl. v. fig. 19 (1906).

6. Lygodactylus capensis A. Smith.

Coguno, Beira.

*7. Homopholis wahlbergii A. Smith.

Coguno.

8. Pachydactylus bibronii A. Smith.

Zoutspansburg.

*9. Agama distanti Blgr.

Woodbush.

This species is also found in the Orange River Colony. Specimens from Vredefort Road were presented to the British Museum by Capt. Barrett-Hamilton, and others were captured by myself near Bloemfontein.

**10. Agama mossambica Peters.

Beira.

*11. Zonurus jonesii Blgr.

Zoutspansburg.

*12. Platysaurus guttatus A. Smith.

Woodbush.

This species varies considerably in its lepidosis, and I do not think *P. intermedius* Matschie entitled to stand. Of the eight specimens from Woodbush three are males and five are females. The males belong to the *guttatus* type of coloration, have the lower parts of the head, body, and limbs dark blue, and the tail red; the females have three whitish longitudinal streaks in addition to the light spots on the head and body, the tail is pale yellowish brown, and only the middle of the belly is bluish black. The occipital shield is small or very small and, except in one specimen, the parietals form a suture separating it from the interparietal; the frontonasal is in contact with the rostral.

	♂	♂	♂	♀	♀	♀	♀	♀
Length to vent (in millimetres)	105	97	90	87	83	80	77	58
Number of scales across body	70	72	78	80	78	75	83	70
Longitudinal rows of ventral plates	16	16	16	18	16	18	18	16
Number of femoral pores (right & left)	16–17	17–16	17–16	19–19	16–16	19–20	17–18	17–18

Having now examined 15 specimens which I refer to *P. guttatus*, I find the scales across the body to vary from 70 to 90, the longitudinal rows of ventral plates from 16 to 20, and the femoral pores on each side from 15 to 20.

P. torquatus Peters, from Mozambique, which differs in the absence of the azygous longitudinal series of enlarged gular scales, has 90 to 100 scales across the body, 16 longitudinal rows of ventral plates, and 17 to 21 femoral pores.

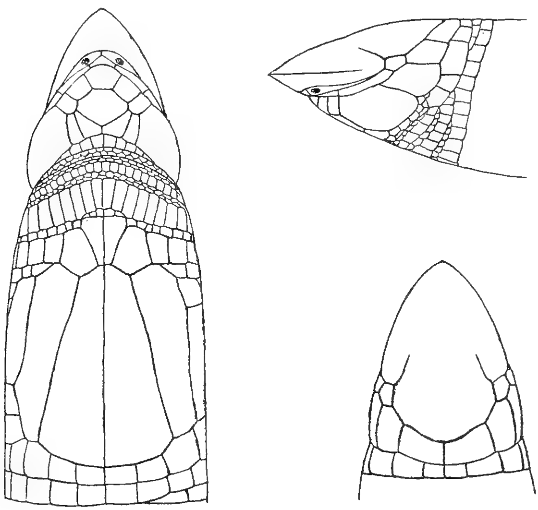
13. VARANUS NILOTICUS L.

Beira.

**14. MONOPELTIS GRANTI, sp. n. (Text-fig. 141.)

Snout pointed; nasals in contact with each other above the very small, triangular rostral; a single large plate covering the head, with a short cleft in front of the ocular, which is small; eye just distinguishable under the ocular; a pair of band-like occipitals; three upper labials, third large; symphysial small, quadrangular, followed by a larger heptagonal chin-shield; three lower labials, first and second small, third very large. 313 annuli on the body, 26 on the tail; on the middle of the body an

Text-fig. 141.



Monopeltis granti.

Upper and side views of head, and lower view of head and pectoral region.

annulus contains 32 segments, 18 above and 14 below the lateral lines; the dorsal segments much longer than broad, the two median ventrals much broader than long. Pectoral shields six, very large, very elongate, the median pair widening posteriorly and as long as the shielded part of the head. Lateral line distinct. Six anal segments. No præanal pores. Colourless.

Length to vent 200 millim.; tail 23; diameter of body 5.

A single specimen from Beira.

Nearly related to *M. welwitschii* Gray, from Angola.

15. MABUIA VARIA Peters.

Woodbush, Beira.

16. Mabuia striata Peters.

Tuefloop, Beira.

*17. Lygosoma sundevalli A. Smith.

Beira.

*18. Herpetosaura arenicola Peters.

Coguno.

Rhiptoglossa.

19. Chamæleon quilensis Bocage.

Coguno, Beira.

*20. Chamæleon dilepis Leach.

Zoutspansburg, Beira.

*21. Chamæleon damaranus Blgr.

Knysna, Woodbush.

Ophidia.

**22. Typhlops dinga Peters.

Beira.

23. Ablabophis rufulus Licht.

Pietersburg.

*24. Boodon lineatus D. & B;

Pietersburg, Beira.

*25. Lycophidium capense A. Smith.

Beira.

*26. Simocephalus capensis A. Smith.

Beira.

27. Pseudaspis cana L.

Coguno.

*28. Chlorophis hoplogaster Gthr.

Beira.

*29. Philothamnus semivariegatus A. Smith.

Beira.

The single specimen has two superposed anterior temporals and the fifth and sixth labials entering the eye on the right side, a single anterior temporal and the fourth, fifth, and sixth labials entering the eye on the left, thus combining characters of Günther's *P. semivariegatus* and *P. kirkii*†.

† *Cf.* Ann. & Mag. N. H. (6) xv. 1895, p. 527.

*30. Leptodira hotambœia Laur.

Beira.

**31. Chamætortus aulicus Gthr.

Beira.
Previously known from Central Africa and the Zambesi.

32. Trimerorhinus rhombeatus L.

Zoutspansburg.

33. Psammophis sibilans L.

Inhambane, Beira.
Like the specimen mentioned in the previous list, belonging to var. F of the British Museum Catalogue.

*34. Thelotornis kirtlandii Hallow.

Legogot.

35. Dispholidus typus A. Smith.

Woodbush, Coguno, Beira.
Some brown, some green.

*36. Aparallactus capensis A. Smith.

Legogot.

*37. Naia nigricollis Reinh.

Woodbush, Coguno, Beira.

*38. Causus rhombeatus Licht.

Tuefloop.

39. Bitis arietans Merr.

Legogot, Inhambane, Beira.

EXPLANATION OF THE PLATES.

Plate XXI.

Bufo regularis Reuss, p. 479.

Figs. 1 & 2. ♀ & yg. from Zoutspansburg.
,, 3 & 4. ♀ & yg. from Woodbush.

Plate XXII.

Fig. 1. *Rana ruddi* (♂) Blgr. p. 480.
1 *a*. Side view of head.
1 *b*. Lower view of head.

Figs. 2–5. *Phrynobatrachus natalensis* A. Smith, p. 482.
Four specimens from Beira.

3. On Collections of the Cape Verde Islands Marine Fauna, made by Cyril Crossland, M.A. (Cantab.), B.Sc. (Lond.), F.Z.S., of St. Andrews University, July to September, 1904.*—The Hydroids. By James Ritchie, M.A., B.Sc., Fullerton Scholar, University of Aberdeen †.

[Received April 18, 1907.]

(Plates XXIII.–XXVI.‡ and Text-figures 142–144.)

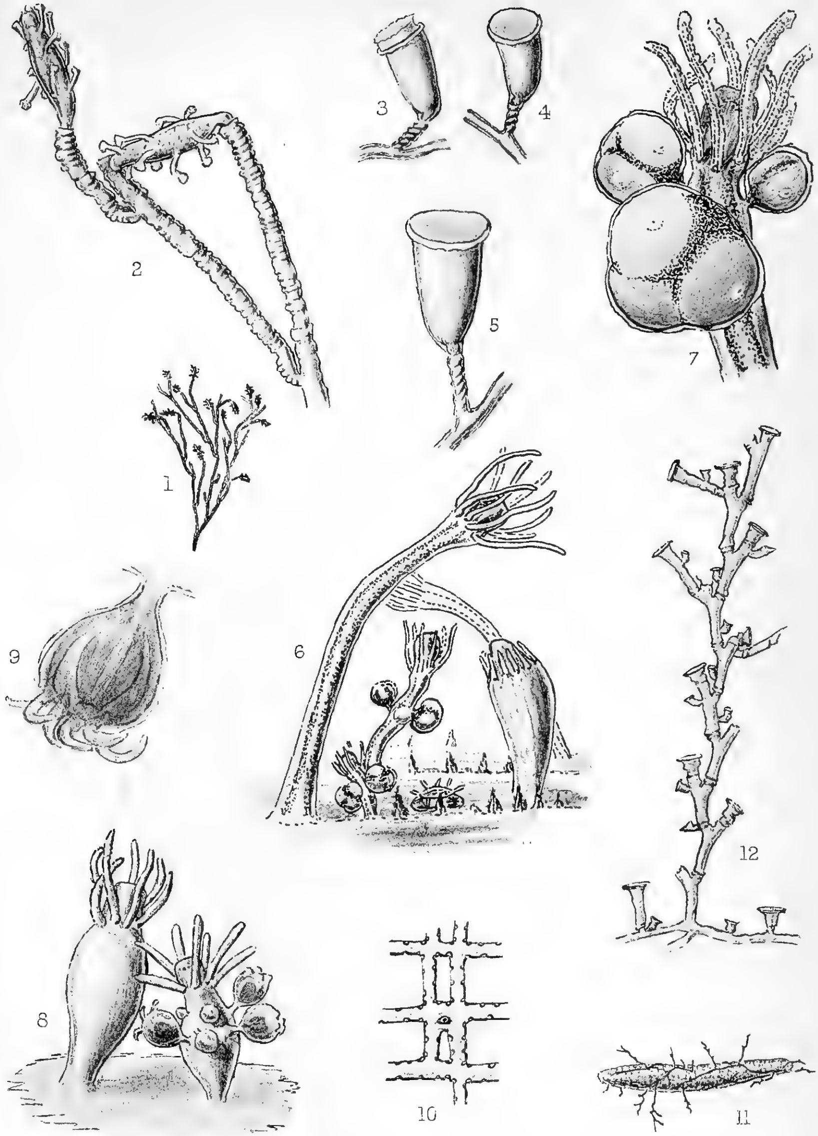
The forms described in the present paper were entrusted to me for determination by Mr. Crossland, who collected them in various localities off the Cape Verde Islands. Although the collection is not a large one, it forms a useful addition to our rather meagre knowledge of the Hydroid fauna of the northern portion of the west coast of Africa. To the north of the Cape Verde Islands specimens have been recorded from the Canary Islands, from Madeira, from the Azores, and from the Soudan coast; from the south the 'Challenger' records a solitary species, *Cryptolaria diffusa* Allm. from Sierra Leone; while from the islands themselves, so far as I can learn, records have been made by only four workers §. In 1883 Allman, in his Report on the Plumularians collected by the 'Challenger,' described the type of a new genus, *Streptocaulus pulcherrimus* Allm., found at Porto Praya in 100 fathoms. In July 1885 Mr. J. J. Quelch described a small collection of deep-sea Hydroids, comprising nine species, and obtained from the cable off St. Vincent in a depth of over 500 fathoms, the species described being *Eudendrium annulatum* Norman 1864, *Lafoëa tenellula* Allman 1877, *Zygophylax profunda* Quelch 1885, *Plumularia variabilis* Quelch 1885, *P. delicatula* Quelch 1885, *Antennularia irregularis* Quelch 1885, *A. profunda* Quelch 1885, *Aglaophenia acacia* Allman 1883, and *Streptocaulus pulcherrimus* Allman 1883. More recently Professor J. Versluys has described two species from Isle Branco, one of the Windward Group, *Sertularia* (*Desmoscyphus*) *brevicyathus* (Vers. 1899), and *Desmoscyphus inflatus* Vers. 1899, a synonym for the *D. gracilis* of Allman 1888, which has been renamed *Sertularia versluysi* by Professor Nutting (1904). Of these the latter occurs in our collection, with the important addition that the gonosome is also present and is here described for the first time. Lastly, within the past month or two collections made by the 'Talisman' in 1883 have been described by Dr. Armand Billard (1907), and these include a few species from two localities off the Islands. In lat.

* The expenses of Mr. Crossland's collecting trip were borne by the Carnegie Trustees.

† Communicated by the Secretary.

‡ For explanation of the Plates, see p. 514.

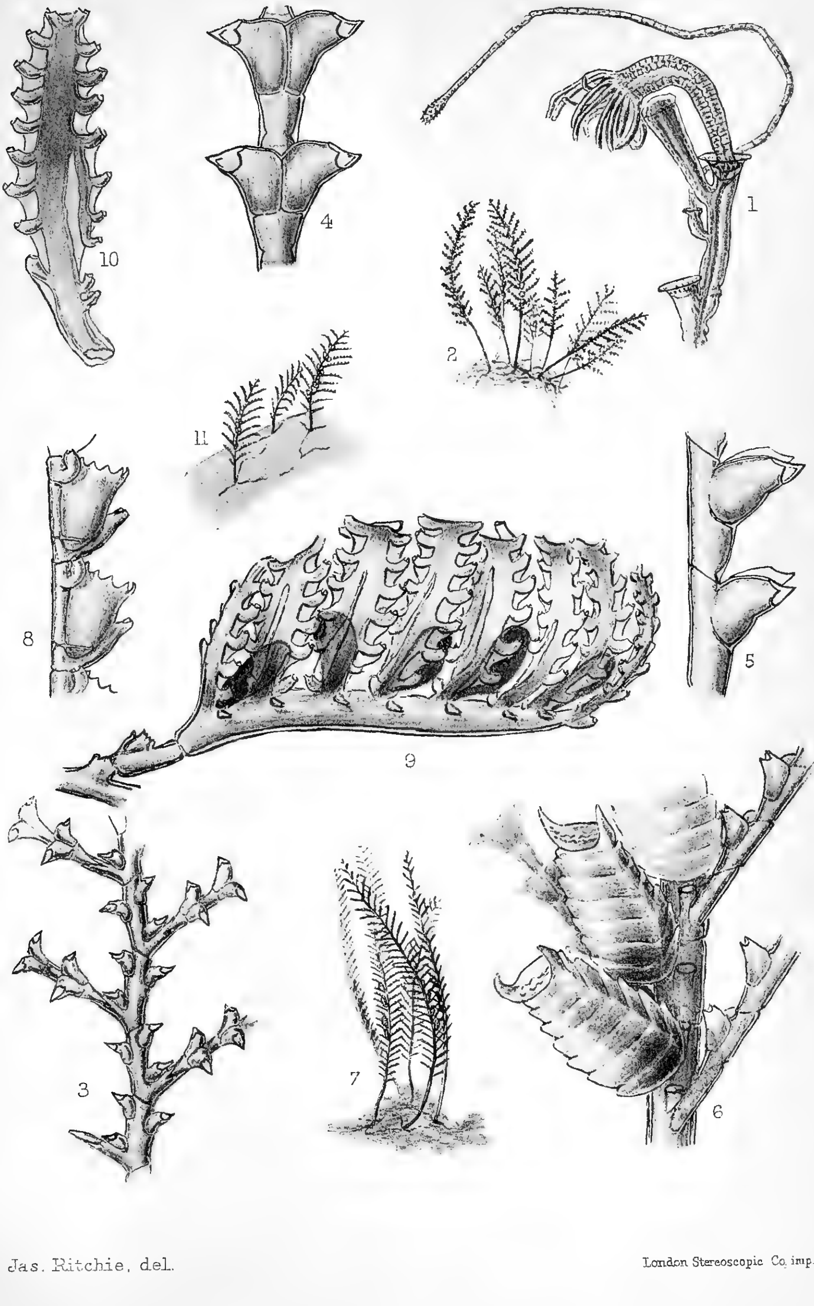
§ Since this paper was written I have found in the collections made by the Scottish National Antarctic Expedition on its homeward voyage two species from St. Vincent which were not represented among the specimens described in the Report on the 'Scotia' Hydroid Collection (Ritchie, 1907). These are *Eucopella cœnata* ? Hartlaub, 1901, and *Sertularella fusiformis* ? Hincks, 1861, both of which are additions to the recorded Hydroid fauna of the Islands.



Jas. Ritchie, del.

London Stereoscopic Co. imp.

HYDROIDS FROM CAPE VERDE ISLANDS.



Jas. Ritchie, del.

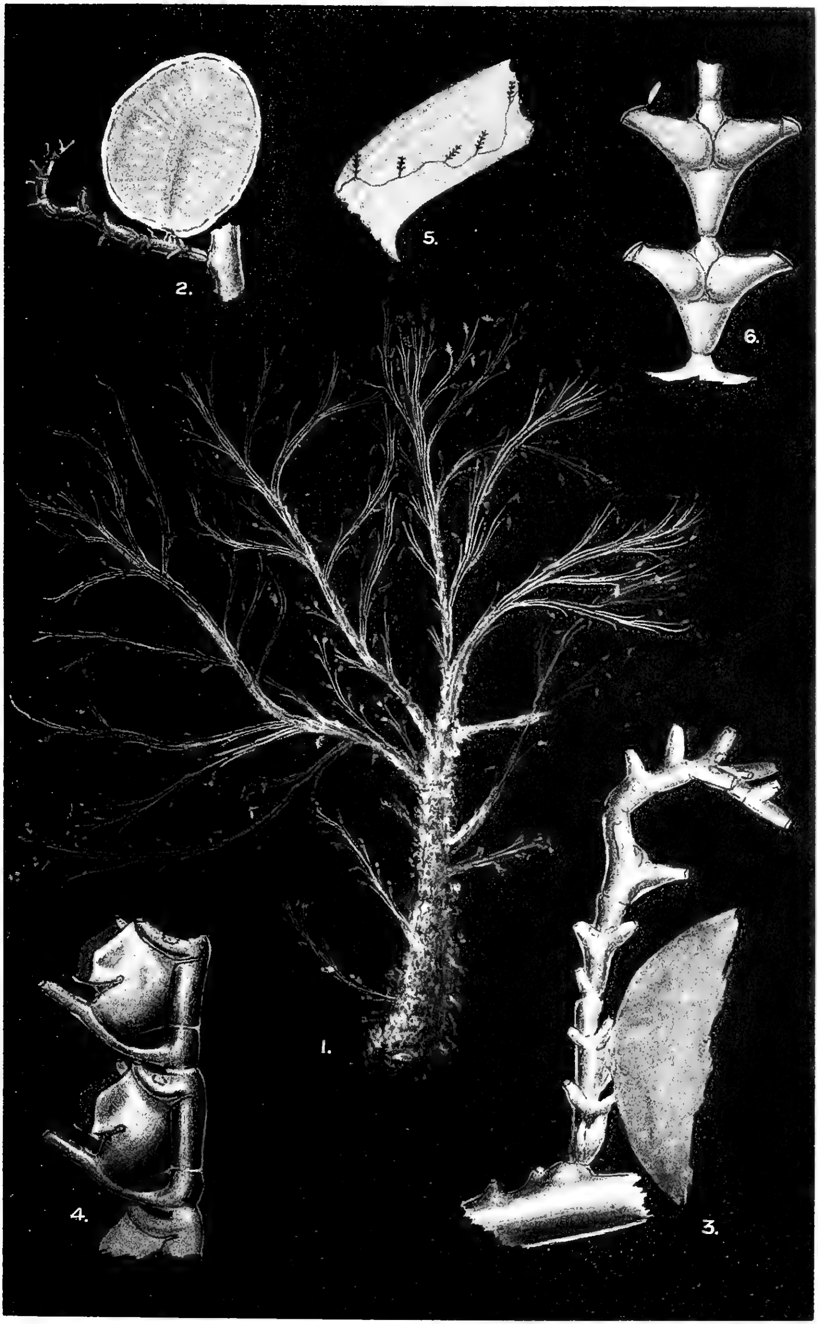
London Stereoscopic Co. imp.

HYDROIDS FROM CAPE VERDE ISLANDS.

Jas. Ritchie, del.

London Stereoscopic Co. imp.

HYDROIDS FROM CAPE VERDE ISLANDS.



Jas. Ritchie, del.

London Stereoscopic Co. imp

HYDROIDS FROM CAPE VERDE ISLANDS.

17° 1′ N. and long. 27° 24′ W. (Paris 0°) at a depth of 105 metres there were obtained *Diphasia pinaster* (Ellis & Sol. 1786), *Antennularia ramosa* Lamarck 1816, and *Thecocarpus myriophyllum* var. *bedoti* Billard 1907. In lat. 16° 52′–16° 53′ N. and long. 27° 30′–27° 26′ W. at a depth of 400–580 metres, *Diphasia pinaster* and *Thecocarpus myriophyllum bedoti* were again found.

The present collection is littoral, the greatest depth at which specimens were gathered being 15 fathoms, while the majority were obtained in shore-pools or in quite shallow water. Hence it is not surprising to find that of the species previously described from the Islands only one, *Sertularia versluysi* above mentioned, should recur among Mr. Crossland's specimens.

The collection contains in all 27 species, of which 18—one of them here represented by a new variety—have been previously described. Several of these species, which are distributed among 14 genera, have been recorded from more than one locality. For the remaining specimens 9 new species have been established, one species being referred to a new genus. In all representatives of 20 genera occur in the collection.

The list of species is as follows:—

I. GYMNOBLASTEA.

Family Corynidæ.
Coryne (?) *dubium*, sp. n.

Family Pennariidæ.
Pennaria cavolinii Ehrenberg 1832.

Family Tubulariidæ.
Tubularia humilis Allman 1864.
,, *solitaria* Warren 1906.

Family Clavidæ.
Soleniopsis dendriformis, gen. et sp. n.

Family Bougainvilliidæ.
Hydractinia verdi, sp. n.
Podocoryne anechinata, sp. n.

Family Eudendriidæ.
Eudendrium ramosum Linn. 1758.

II. CALYPTOBLASTEA.

Family Haleciidæ.
Halecium beanii Johnst. 1838.
Ophiodes caciniformis, sp. n.

Family Lafoëidæ.
Filellum serpens (Hassall 1852).
Cuspidella humilis Hincks MS. & 1866.

Family Campanulariidæ.
Clytia geniculata Thornely 1904.
Obelia dichotoma (Linn. 1758).
Gonothyræa gracilis (Sars 1851).
Campanularia caliculata Hincks 1863.
,, *ptychocyathus* Allman 1888.
,, *mutabilis*, sp. n.

Family SERTULARIIDÆ.

Sertularia distans Lamx. 1816.
„ *mayeri* Nutting 1904.
„ *versluysi* Nutting 1904.
„ *lævimarginata*, sp. n.

Family PLUMULARIIDÆ.

Plumularia halecioides Alder 1859.
Monostæchas quadridens (McCrady 1857).
Aglaophenia marginata, sp. n.
Lytocarpus grandis, var. *unilateralis*, var. n.
„ *crosslandi*, sp. n.

Of the 18 hitherto known forms above mentioned, 10 are recognised as British species, while 5 of the remainder (*Campanularia ptychocyathus*, *Sertularia mayeri*, *S. versluysi*, *Lytocarpus grandis*, *Monostæchas quadridens*) are, with the exception of the last which has been recorded from the Indian Ocean (Thornely, 1904), distinctively American. This contingent is probably to be accounted for by the oceanic whirlpool the centre of which is marked by the Sargasso Sea and the streams of which wash the shores of the West Indies, of eastern Mexico, and of the eastern United States, and, circling in the North Atlantic, sweep past the Azores, Madeira, and the Cape Verde Islands.

The collection, as might be expected in a littoral one, is comparatively rich in gymnoblastic forms and includes an interesting species, peculiar in branching and in gonophore, which has been made the type of a new genus, *Soleniopsis*.

We note also, as Pictet has already remarked (Pictet, 1893), that of those species which occur both in temperate and in tropical waters, the individuals existing in the colder seas are, in general, larger and more sturdy than their tropical specific equivalents.

The outlines of the figures, both in the plates and in the text, with the exception of those representing the appearance of the specimens to the unaided eye, were drawn with the help of Zeiss's camera lucida.

The localities from which Mr. Crossland obtained his specimens are shown below:—

ST. VINCENT, CAPE VERDE ISLANDS.

(1) GENERAL.

(*a*) From tidal pool, 25th July, 1904.
Pennaria cavolinii Ehr.

(*b*) 2 fathoms, among coral, 22nd July, 1904.
Pennaria cavolinii Ehr.
Sertularia mayeri Nutt.
Plumularia halecioides Hincks.

(*c*) 10 fathoms, 27th July, 1904.
Gonothyræa gracilis Sars.
Campanularia ptychocyathus Allm.

(*d*) 15 fathoms, 30th July, 1904.
Monostæchas quadridens (McCrady).
Lytocarpus grandis, var. *unilateralis*, var. n.

(*e*) From bottom of a lighter, 20th July, 1904.
Tubularia humilis Allm.
Cuspidella humilis Hincks.
Plumularia halecioides Alder.
Aglaophenia marginata, sp. n.

(*f*) From bottom of a lighter, 30th July, 1904.
Pennaria cavolinii Ehr.
Tubularia humilis Allm.
„ *solitaria* Warren.
Soleniopsis dendriformis, gen. et sp. n.
Halecium beanii Johnst.
Filellum serpens (Hassall).
Cuspidella humilis Hincks.
Clytia geniculata Thorn.
Obelia dichotoma Linn.
Campanularia ptychocyathus Allm.
„ *mutabilis*, sp. n.

(2) Mattiota, St. Vincent Harbour.
Sertularia lævimarginata, sp. n.
Lytocarpus crosslandi, sp. n.

(3) Porto Grande.

(*a*) Shore-pools.
Campanularia caliculata Hincks.
„ *ptychocyathus* Allm.
Sertularia distans Lamx. 1816.
„ *mayeri* Nutt.

(*b*) 10 fathoms.
Hydractinia verdi, sp. n.

PORTO PRAYA, Santiago, Cape Verde Islands.

(*a*) Piles of pier, 12th August, 1904.
Coryne (?) *dubium*, sp. n.
Campanularia mutabilis, sp. n.
Sertularia versluysi Nutt.

(*b*) 5 fathoms, 9th August, 1904.
Podocoryne anechinata, sp. n.

(*c*) 10 fathoms, 12th August, 1904.
Eudendrium ramosum Linn.
Ophiodes caciniformis, sp. n.

BOA VISTA, Cape Verde Islands.
Soleniopsis dendriformis, gen. et sp. n.

I. GYMNOBLASTEA.

Family Corynidæ.

Coryne (?) dubium, sp. n. (Plate XXIII. figs. 1, 2.)

A species represented by small, irregularly ramified colonies growing upon a *Polysiphonia*-like red seaweed. The colonies are only about 7 mm. in height. The perisarc is transparent, tinged, except towards the tips of the branches, with a faint brown. The stem is slender, 0·1 mm. in diameter, and soon breaks up into very numerous, irregularly disposed branches which, arising at a small angle, lie for a short distance almost parallel with their parent shoot and thereafter gradually diverge from it. Branches even of the fourth order are present. The colonies are wrinkled throughout, but less strongly in the middle portions of the polyp-bearing branches; while beneath the polyp, on the stems, and on the older portions of the branches distinct ringing occurs. There is no membranaceous cup surrounding the base of the hydranth. The hydranths are relatively long, 0·5 mm., slightly bulging beneath and tapering gradually upwards towards the tip and downwards to form a long "neck." The tentacles are from 0·1 to 0·15 mm. in length, and except for the distal four, which generally appear to be placed in a whorl, are scattered. They vary slightly in number. Thus of 10 heads examined, one bore 12 tentacles, four bore 13, three bore 14, and on two 15 were found.

Gonosome not present.

Locality. Growing on a seaweed taken from piles of pier. Porto Praya, Santiago, Cape Verde Islands; 12th August, 1904.

Owing to the absence of the gonosome this species cannot be given a definite generic place within the family Corynidæ as defined by Delage (1901). Notwithstanding I have assigned a specific name to the form in order to facilitate references. The trophosome characters lie between those of *Actinogonium pusillum* (Van Beneden 1844; Hincks, 1868, p. 45; Allman, 1872, p. 272) and *Syncoryne sarsii* Lovén 1835. From the former it differs in having a more tapering polyp, numerous rings and wrinkles, and in lacking a membranaceous cup beneath the polyp; from the latter it is distinguished by the shape of its hydranth, its much smaller size, its complicated branching, its more frequent rings.

The specimens bear many creeping polyzoon colonies (*Clionella*?) and occasional stalked protozoa and diatoms.

Family Pennariidæ.

Pennaria cavolinii Ehrenberg 1832.

A number of colonies, frequently over 6 cm. in height, have been obtained from one locality. They agree in general with Allman's description (1872, p. 364), but the following variations may be noted:—The colonies are less robust than those described by Allman. The branches, while alternate, lie generally in two planes, every other branch being in the same plane, and these planes are set forward on the stem, as in many Plumularian species, so as to meet at an angle varying from almost 180° to less than 20°. Ringing is well marked, from four to six rings occurring on the stem above the origin of each branch, and a similar number at the base of the branch itself. Thus the ultimate hydranth-bearing ramuli, instead of being wholly ringed as described and figured by Allman, bear a small number of basal rings; the remainder, which varies much in length, being smooth or very slightly crumpled.

The gonosomes, which are present in numbers, agree exactly with Allman's description.

The colonies here described agree in all but size with beautifully preserved specimens of the species from the Naples Biological Station.

Locality. St. Vincent, Cape Verde Islands. Obtained from bottom of a lighter, 30th July, 1904; by diving among coral in 2 fathoms of water, 22nd July, 1904; also fine colony in tidal pool, 25th July, 1904.

Family TUBULARIIDÆ.

TUBULARIA HUMILIS Allman 1864.

A few simple or slightly branched stems varying from 0·5 to 4 cm. in height, and 0·5 mm. in diameter, may be referred to this species. The specimens obtained in one dredging are much smaller than those described by Allman, varying from 5 to 12 mm. in height; but the following points have been relied on in identification:—simple or slightly branched stems with, here and there, faintly marked transverse rugosities; delicate, light-yellow perisarc; a cœnosarcal collar supporting the hydranth; small hydranths, 1·2 mm. in height, longer than broad, with, in the individuals examined, 17, 13, 11 tentacles in the distal whorl, and 19, 17 in the proximal. The tentacles are in a state of contraction, and consequently the proximal whorl is only 1·8 mm. in diameter from tip to tip.

Gonosome.—In the specimens obtained on the 30th of July gonophores are present in erect clusters borne on short pedicels. In some of the more mature, actinulæ can be seen.

Locality. St. Vincent, Cape Verde Islands. Found growing on the bottom of a lighter on 20th and 30th July, 1904, and by diving among coral in 2 fathoms of water on 22nd July, 1904.

TUBULARIA SOLITARIA Warren 1906.

A few solitary individuals, 8 mm. in height, are growing upon a sponge-like layer encrusting a small lamellibranch shell. The individuals are fixed in the layer by a club-like, sometimes branched "root," and are crowned by a distal circle of stout tentacles 13 or 14 in number, the lower portions of which are adnate to the hypostome, appearing as strong ridges upon it. The proximal tentacles, which are more slender than the distal, arise from the broadened base of the hydranth in a whorl of about 30, rather more than in Dr. Warren's specimens. Otherwise, the present specimens, with delicate perisarc, distinct endodermal canals in the hydrocaulus, erect blastostyles originating just within the proximal whorl of tentacles and bearing from two to five or six gonophores, agree with the description of the type.

The gonophores in our specimens are mostly at an early stage, showing in optical section a manubrium surrounded by a horse-shoe-shaped mass of generative plasma. In only one gonophore of the many examined was there a trace of actinula-formation, tentacles being indicated by apparently about 8 filaments.

Locality St. Vincent, Cape Verde Islands. Found on bottom of a lighter, 30th July, 1904.

Previous record, off Natal coast.

Family Clavidæ.

Soleniopsis *, gen. nov.

Type. *S. dendriformis*, sp. n.

Generic characters.—*Trophosome.* Colonies branched and fascicled. The branches originate from the division of a cœnosarcal strand into two portions which lie parallel and close to one another for a considerable distance, each becoming sheathed in a chitinous perisarcal tube, the outermost strand finally bends outwards and becomes free to form a branch (*vide* text-fig. 142, p. 496). The hydranth-bearing ramuli originate in the same way as the branches. Hydranths cylindrical, with club-shaped proboscis and many scattered filiform tentacles.

Gonosome.—The reproductive bodies are permanently fixed gonophores of a simple type. They are blind sacs arising from the cœnosarc some distance beneath the hydranth and lying within the perisarcal tube from which the hydranth projects. The ova are developed in the wall of the sac.

The genus *Soleniopsis* is distinguished by its peculiar mode of branching and by its gonophore. The branching, which is more fully described in the discussion on the species, appears to be similar to that of *Corydendrium* (Weismann, 1883). I have not seen the original description, but Dr. Fowler says with regard to the branching of the genus, "The young buds, instead of breaking through the perisarc and growing outwards as is usual, grow upwards for some distance inside it and surround themselves with secondary perisarc" (Fowler, 1900, p. 13); and this agrees with the structure in the present genus. *Corydendrium* differs from *Soleniopsis*, however, in having gonophores which give rise to free medusæ (Delage, 1901).

The gonophores here are of great length and of extremely simple structure. They are also peculiar in lying within, and thus being protected by, the tube which contains the trophosome, instead of bursting through the perisarc and forming hernia-like globular projections like most other gonophores. The ova and spermatozoa apparently escape from the mouth of the tube, passing between the swollen bulb beneath the neck of the hydranth and the perisarcal wall.

On account of the scattered filiform tentacles on the hydranth

* The name of the genus, *Soleniopsis,* is intended to suggest the resemblance between the parallel-lying cœnosarcal strands of the colony and the "solenia" of Alcyonarians.

and of the fixed gonophore, this genus has been included in the family Clavidæ, although the simplicity of the gonophore and the complexity of the branching almost warrant the formation of a new family.

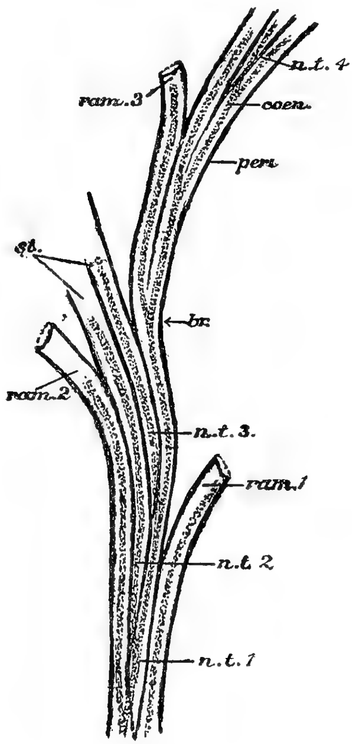
SOLENIOPSIS DENDRIFORMIS, sp. n. (Plate XXVI. fig. 1; text-figs. 142, 143.)

The colonies for which this species has been formed were found at two localities. The solitary colony from Boa Vista is the largest of the series, almost 10 cm. high, with a thick, fascicled stem which is, towards the base, covered by a mass of ramifying tubes, forming a spongy tissue through which here and there a hydranth projects. This loosely-built basal mass attains a diameter of 1 cm. From this stem, which in transverse section shows a small central strand of chitin with a few minute cœnosarc-containing canals, surrounded by many parallel tubes which again are surrounded by irregularly arranged, loosely aggregated tubes, the branches arise approximately in one plane. The colonies from St. Vincent are smaller, only 6 cm. high, and lack the spongy basal thickening, possessing a cylindrical stem 2 mm. in diameter, composed of closely packed parallel tubes. From these stems, as from that of the previous specimen, flabellate branches lying generally in one plane arise. The primary branches bear alternate secondary branches, and these again may bear tertiary branches, all of these appearing to be fascicled owing to the apposition of several tubes. Single, monosiphonic branches, however, arise alternately in one plane, for the most part from branches of the second and third order, and from the distal end of these the hydranths project.

The mode of branching is peculiar. In the less strongly fascicled portions of the stem two or three perisarcal tubes lie alongside of, and inseparably united to, one another, each containing a strand of cœnosarc. Some considerable distance before a free branch originates (frequently 20 or 30 mm.) one of the outermost strands divides into two, and round the new cœnosarcal division a chitinous tube is formed, wedged in between the old tubes. Thus the number of parallel-lying and united tubes is increased, but finally, after a course of some 2 or 3 cm., the outermost of the two portions into which the original strand divided becomes free to form a branch, and the number of tubes in the fascicle is thus reduced. The cœnosarc of the free branch divides, as did that of the stem, and becomes ensheathed in several united tubes which, on bending outwards and becoming free, form new branches or hydranth-bearing ramuli. The division of the cœnosarcal strands, and consequently the origin of the branches and ramuli, takes place alternately, first on one side, then on the other.

The hydranths project from simple, alternate ramuli 0·4 mm. in diameter. Extended they are long and slender, 2·0 mm. by 0·2 or 0·3 mm., almost cylindrical, with a prominent club-shaped proboscis and short (0·3 mm.) stumpy tentacles. These, between 40 and 50 in number, are scattered over the body of the polyp, only the distal 4 or 5 being placed in a whorl, although an approximation to whorling is sometimes simulated by others of the tentacles. At the proximal end of the hydranth there is a short neck, and just within the margin of the tube a sharp bulge connecting the polyp with the cœnosarc of the ramulus and almost

Text-fig. 142.



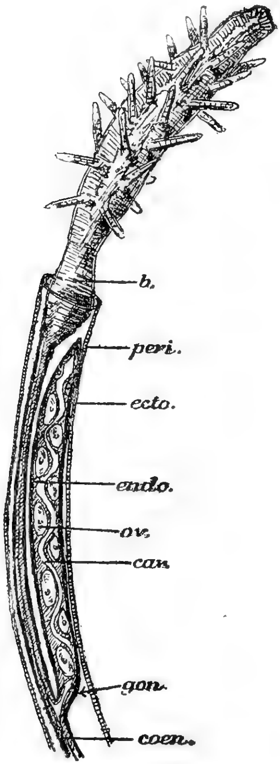
Soleniopsis dendriformis. To show mode of branching, ×8.

cœn., cœnosarc; *peri.*, perisarc; *br.*, branch bending off and becoming free from main stem; *st.*, main stem; *ram.* 1, 2, 3, short ramuli from which hydranths project; *n.t.* 1, 2, 3, 4, new tubes, enveloping a branch from a cœnosarcal strand and wedged in between older tubes.

plugging up the entrance to the tube. Contracted, the hydranths form almost spherical bulbs about 0·7 mm. in diameter. Although the tube from which the hydranth springs generally ends abruptly with an even circular margin, in not a few cases the terminal portion is wrinkled and twisted as if it were less strong, more collapsable than the other portions.

Gonosome.—The gonophores are fixed, not developing into free medusoids, and lie within the tube from which the hydranth projects. They branch off from the cœnosarc of the ramulus from 2 to 3 mm. below the hydranth itself, and are long, slender, spindle-shaped bodies, sometimes 2·5 mm. in length by 0·1 mm.

Text-fig. 143.



Soleniopsis dendriformis. Hydranth and gonophore, ×30.

b., bulging portion at base of hydranth almost filling the opening of the tube; *peri.*, perisarc; *ecto.*, ectoderm, represented within the tube by a dark line; *endo.*, endoderm (lined); *ov.*, ovum; *cav.*, central cavity of gonophore; *gon.*, the arrow points to the place where the gonophore branches off the general cœnosarc; *cœn.*, general cœnosarc.

in diameter. Their structure is simple, the gonophore being apparently a hollow cylinder closed distally, with two-layered walls, a thick ectoderm and thinner endoderm, within which ova develop to the number of about 13 or more. The ova develop all along the walls, pushing the endoderm inwards until it protrudes into the hollow of the gonophore. The male gonophores are similar in origin and shape to the female, but are in general considerably longer. In no case could a spadix be distinguished.

The structure of the gonophore above described is of the simplest type. It appears to be merely a blind branch of the general cœnosarc of the colony within the walls of which ova develop.

Associated with the specimens were several creeping Hydroids, *Filellum serpens, Cuspidella humilis, Campanularia mutabilis*, and an endoproctan polyzoon (*Clionella* ?).

Localities. (*a*) St. Vincent, Cape Verde Islands: growing on the bottom of a lighter, 20th and 30th July, 1904.—(*b*) Dredged; Boa Vista, Cape Verde Islands, August ? 1904.

Family Bougainvilliidæ.

Hydractinia verdi, sp. n. (Plate XXIII. figs. 6 & 7.)

Among dredgings taken at Porto Grande four *Fusus*-like gasteropod shells were obtained overspread by Hydractinia colonies. The nutritive hydranths, which grow in the grooves of the shell-sculpture, are in various stages of contraction, the longest 5 mm., the shortest with their ring of tentacles almost resting on the surface of the shell. The tentacles are short, set in two almost indistinguishable whorls, and vary in number from 9 to 12, 9 being perhaps most frequent. The hypostome is club-shaped. No spiral filaments are present, although along the margin of the shell there occur elongated polyps with insignificant tentacles. Short chitinous spines, about 0·3 mm. long, with jagged edges, occur throughout the colony, being arranged for the most part upon the ridges of the shell. The blastostyles are somewhat smaller than the nutritive hydranths, being about 1 mm. in height, but unlike those of *H. echinata* they bear well-developed tentacles eight or nine in number. The basal rhizom expansion is thin.

Gonosome.—The reproductive bodies are fixed gonophores arising from the body of the blastostyle some distance below the tentacles. They occur in a single whorl containing three or four individuals and are borne on short peduncles. In the specimens examined the gonophores were all female, containing three large ova; while in the more mature examples these were separated towards the exterior by pigmented bands running from the base towards the summit of the gonophore—branches of the spadix.

This species is closely related to *H. pacifica* described from Calbuco by Hartlaub (1905, p. 519), but that species differs in possessing about 15 tentacles on the nutritive hydranths, only 5 or 6 on the blastostyles; in lacking spines on the basal expansion; in bearing only one ovum in each gonophore.

Locality. Porto Grande, St. Vincent, Cape Verde Islands; 10 fathoms.

Podocoryne anechinata, sp. n. (Plate XXIII. figs. 8, 9, 10.)

Sparsely scattered upon a small gasteropod shell (*Cerithium*? sp.) are the minute individuals of a Podocoryne colony. The nutritive individuals are club-shaped, only 0·9 mm. in height, with a prominent, cylindrical, flat-topped hypostome, from beneath which arise about nine tentacles, set in two closely approximated whorls. Both spiral filaments and spines are absent. The reproductive polyps, although they are somewhat smaller than the nutritive with about seven well-developed tentacles, resemble the latter in shape, being also club-like and possessing a prominent cylindrical hypostome. The basal expansion is formed of a single layer of chitinous tubes, forming wide rectangular meshes, the individual tubes being almost 0·1 mm. in diameter, and being marked laterally by minute honey-yellow dots, thickenings of the chitinous wall. The whole expansion is covered by a thin layer of cœnosarc.

Gonosome.—The sexual stage consists of free-swimming medusoids which arise in considerable numbers (as many as nine being present on one individual) from the median portion of the reproductive polyp. They are borne on well-defined peduncles. During the earlier stages the tentacles appear as four blunt knobs, but these develop considerably ere the medusoid is set free. Sexual products could not be distinguished in the medusoid buds.

The species here described is a near relative of *P. humilis* Hartlaub 1905. The latter form, however, differs in possessing a minute conical hypostome, small smooth spines, and a medusoid bud which is not mentioned as developing well-formed tentacles ere it is set free. The difference in the number of tentacles is of little importance, although it is to be noted that here they form two closely-set whorls, but the chitinous thickenings which occur along the sides of the rhizom strands (*vide* Pl. XXIII. fig. 10) may help to distinguish the present species.

Locality. Porto Praya, Santiago, Cape Verde Islands, 5 fathoms; 9th August, 1904.

Family Eudendriidæ.

Eudendrium ramosum Linnæus 1758.

A single, small, unfascicled colony about 4 cm. high. The branches and branchlets are strictly alternate, and the minute structure, except that the rings at the bases of the main branches are generally fewer in number, agrees closely with Hincks's figures (1868, pl. 13). The hydranths are well preserved and there were, in the examples counted, 23 or 24 tentacles surrounding a very distinct trumpet-shaped hypostome.

Gonophores not present.

Locality. Porto Praya, Santiago, 10 fathoms; 12th August, 1904.

II. CALYPTOBLASTEA.

Family HALECIIDÆ.

HALECIUM BEANII Johnston 1838.

Several strongly fascicled, irregularly branched colonies. The delicate structure of the terminal branchlets is characteristic of the species. The branches differ from those in the specimen figured by Allman (1888, pl. xii. fig. 3 *a*) in arising laterally from below a hydrotheca, instead of directly from the branch. The majority of the primary hydrothecæ differ from Allman's and from Hincks's (1868) figures in being sessile and adnate to the node from which they arise—the hydrotheca-tier springing from within the primary hydrotheca; but in these respects they agree with specimens from the French coast described by Dr. A. Billard (1904, p. 163), and with specimens from dredgings made by the Scottish Antarctic Expedition at Burdwood Bank, near Cape Horn (Ritchie, 1907).

The bright refringent points which encircle the base of the hydrotheca are in this species, as in others I have examined (1907, p. 515), points of attachment for strands from a fleshy disc at the base of the polyp, which is thus supported within its minute hydrotheca.

The gonosome is absent in the present specimens.

Locality. St. Vincent, Cape Verde Islands, growing on the bottom of a lighter; 30th July, 1904.

OPHIODES CACINIFORMIS, sp. n. (Plate XXIII. figs. 11 & 12; Plate XXIV. fig. 1; Plate XXV. fig. 5.)

Several small, delicate colonies, for which this species has been formed, arise at irregular intervals from a hydrorhizal stolon creeping upon a fragment of a sand-covered worm-tube. They are neither branched nor fascicled, and the largest is but 6·5 mm. in height. The stem is divided into short internodes, 0·4 mm. long in the proximal, but gradually lengthening to 0·6 mm. in the upper part of the colony. The distal end of each internode appears to divide into two equal, slightly diverging portions, one of which forms the peduncle of a hydrotheca, while the other bears the succeeding internode, the junction between the two internodes being marked by a single annulation.

The hydrothecæ lie in one plane, are placed one on each internode, and are alternate. They are borne on peduncles of varying length, from 0·05 to 0·2 mm., the upper portions of which are delicate and frequently crumpled, while the bases are thick-walled and, even when the hydrotheca itself has been destroyed, remain as projecting processes. The hydrothecæ themselves are shallow, trumpet-shaped cups, with much-everted margins, delicate walls, and a thin septum separating their cavity from that of the stem. Around the wall just within the margin is a row of refringent points formed by slight thickenings of the perisarc within the hydrotheca, and to these are attached strands supporting a flattened disc-like portion at the base of the polyp. Such an attachment, of course, makes the retraction of the polyp impossible. The structure is identical with that which I have already described and figured in the genus *Halecium* (Ritchie, 1907, p. 525), except that in *Halecium* the basal disc rests upon the perisarcal septum at the bottom of the cup, while here a considerable space intervenes between the two, traversed by a narrow strand of cœnosarc connecting the polyp with the common cœnosarc of the colony. I would draw attention to the seeming inaccuracy of Hincks's figures (1868, pl. 45. figs. 2, 2′) as regards the relations between polyp and hydrotheca. The hydranths, which are about 0·9 mm. in height, gradually increase in diameter upwards from the basal disc, but exhibit no distal contraction beneath the tentacles such as Hincks figures. The bases of the tentacles, which number about 23, are connected by a web within which the hypostome arises. A secondary hydrotheca, borne on a relatively long peduncle, may arise from the lower portion of the peduncle of a primary hydrotheca.

Nematophores occur frequently but irregularly. There is usually one on a peduncle, and sometimes one on an internode. They are sessile, cup-shaped, with delicate walls and everted margin, within which there is commonly a row of refringent dots. To these, as in the hydrothecæ, a basal cœnosarcal disc is attached. The sarcostyles correspond to those figured by Hincks (1868, pl. 45), with thin walls bearing scattered cnidoblasts, and a globular head where large numbers of these offensive and defensive cells are aggregated. When contracted, a sarcostyle measures about 0·4 mm., while one which was extended measured 2·0 mm. The cnidoblasts are narrowly oval, 17 μ by 3 μ, and each contains a thread 220 μ long, armed near the base with a whorl of four barbs in the form of a cross, distal to which are smaller barbs pointing towards the tip of the thread and placed in four longitudinal rows, each of which contains about nine gradually decreasing barbs (Plate XXV. fig. 5). The cnidoblasts occur throughout almost the whole colony, but are particularly common on the basal discs of sarcostyle and polyp, and at the tips of the sarcostyles and of the tentacles.

Occasionally solitary hydrothecæ and nematophores arise from the hydrorhizal tube.

The gonosome is not present.

Locality. Porto Praya, Santiago, 10 fathoms; 12th August, 1904.

Family Lafoëidæ.

Filellum serpens (Hassall 1852).

This species is represented by scanty specimens creeping on a fragment of a Gymnoblast colony. In essential characters the specimens agree with Hincks's description (1868), but they appear to be of less robust growth, while the margins of the hydrothecæ are frequently marked by several "regeneration-lines," as in specimens from the North Sea in my possession.

The coppinia-gonosome is not present.

Locality. Creeping on *Soleniopsis dendriformis*, which was found growing on the bottom of a lighter: St. Vincent, Cape Verde Islands; 30th July, 1904.

Cuspidella humilis Hincks MS. & 1866.

Minute hydrothecæ arising here and there from a tubular stolon creeping upon *Soleniopsis dendriformis*. The hydrothecæ are delicate and cylindrical, generally 0·2 mm. in height by about 0·05 in diameter, although a rare specimen attained a height of 0·4 mm. They show in many cases a tendency to contract slightly towards the proximal end, while the distal end is crowned by convergent opercular segments. They agree with Hincks's description and figures of the species.

Gonosome not known.

Locality. (*a*) Creeping upon a polyzoon, which was obtained growing on the bottom of a lighter: St. Vincent, Cape Verde Islands; 20th July, 1904.—(*b*) Upon *Soleniopsis dendriformis*; 30th July, 1904.

Family Campanulariidæ.

Clytia geniculata Thornely 1904.

Several small colonies, the largest rather under 1 cm. in height, growing on a polyzoon. The specimens agree in every respect with the original description and figures, the peculiar method of branching being particularly noticeable. The hydrothecæ, which are some 1·1 mm. long by 0·6 mm. in greatest diameter, bear from 18 to 20 long teeth; each tooth being strengthened by a median fold which is continued for a short distance down the wall of the hydrotheca as a more or less definite line.

The gonangia vary somewhat as regards their opening, sometimes having a plain, cylindrical, distal end; at other times with a distinctly constricted neck below the aperture. Sometimes they arise in pairs from the base of a pedicel.

Locality. Growing on polyzoa found on the bottom of a lighter; a single specimen on the back of a small crab. St. Vincent, Cape Verde Islands; 30th July, 1904.

Obelia dichotoma (Linnæus 1758).

A few delicate colonies, the largest only 4 mm. high, occur on the carapace of a minute crab. The stems, which are unfascicled, are divided by slanting nodes into regular internodes 0·4 mm. in length, from the distal end of each of which arises a hydrotheca. Branches are frequent, sometimes 1·5 mm. in length, arising in every case from the side of a pedicel. They are thus alternate, and, like the stem, they bear alternate hydrothecæ, from the pedicels of which smaller branchlets with one hydrotheca may arise. Frequently the branches end in blind stolons. The hydrothecæ are alternate and are borne at the distal ends of the internodes on short pedicels marked by four or five annulations, the base of the internode above that from which the pedicel springs bearing a like number of rings. The calycles are short and subtriangular, with a rather wide aperture and an almost even, delicate rim. The whole colony is of delicate texture, the perisarc being remarkably clear and hyaline.

Gonosome not present.

The form described above seems to be a young stage of *O. dichotoma* Linn. Its much smaller size, its lack of horn-colour, its branches arising from *the side* of a pedicel, and the shorter subtriangular shape of its hydrothecæ, are differences insufficient to distinguish it specifically from the older form.

Locality. On the carapace of a small crab found crawling on the bottom of a lighter: St. Vincent, Cape Verde Islands; 30th July, 1904.

GONOTHYRÆA GRACILIS (Sars 1851).

A few small specimens of this beautiful species occur growing upon a fragment of calcareous material. The colonies are only 8 mm. in height, and differ from those described and figured by Hincks (1868) in that the hydrothecæ are somewhat less slender. The remaining characters—the peculiar origin of the branches, stuck on, one would almost think, as an afterthought, the gradual tapering of the hydrotheca towards its base, the number of the long pointed teeth, the ringing beneath the hydrotheca and at the proximal end of the branches—agree with previous descriptions.

Two long slender gonangia, with traces of a marginal collar as in Hincks's figures, are present, one arising from the hydrorhiza, the other from a peduncle.

Locality. St. Vincent, Cape Verde Islands, 10 fathoms; 27th July, 1904.

CAMPANULARIA CALICULATA Hincks 1863.

Typical examples of this species, with crenated pedicel, distal spherical segment, and thick-walled, smooth-rimmed hydrothecæ, occur creeping on a seaweed. In our specimens the pedicels average 0·5 mm. in length and are marked by about 10 crenations.

The gonangia are absent.

Locality. Porto Grande: creeping on seaweed in a shore-pool.

CAMPANULARIA PTYCHOCYATHUS Allman 1888.

Numerous crowded, pedunculate hydrothecæ, and gonangia springing from a creeping stolon have been found on a polyzoon. The specimens agree closely with Allman's description and figures, especially characteristic being the delicate, frequently collapsed, distal portion of the hydrotheca, which in our specimens bears 10 long teeth; the stem with a few rings (generally two) beneath the hydrotheca and with several at the base; the smooth cylindrical gonangia with marked constriction beneath the shallow saucer-like top.

From locality *c* there are only a few hydrothecæ growing upon *Sertularia distans*, gonangia being absent.

Localities. (*a*) Creeping on a polyzoon found on the bottom of a lighter: St. Vincent, Cape Verde Islands; 30th July, 1904.—(*b*) On a pebble, 10 fathoms: St. Vincent; 27th July, 1904.—(*c*) Creeping on *Sertularia distans*: Porto Grande, shore-pools; ? July, 1904.

CAMPANULARIA MUTABILIS, sp. n. (Plate XXIII. figs. 3, 4, 5.)

Rare specimens occur creeping upon *Sertularia versluysi* and *Soleniopsis dendriformis.* From a thick-walled, creeping, hydrorhizal tube the hydrothecæ arise at irregular intervals. They are borne on thick-walled peduncles with a length roughly three-fourths that of the hydrotheca, varying from 0·4 to 0·8 mm., and marked by from four to eight well-defined twists. The hydrothecæ are large but vary from 0·8 to 1·2 mm. in length and from about 0·5 to 0·6 mm. in breadth. They are almost campanulate in shape, gradually widening upwards to the margin, which is frequently oblique, is beautifully recurved, and is sometimes reduplicated (Pl. XXIII. fig. 3). A slight ridge of perisarc at the base of the hydrotheca forms a platform upon which a cœnosarcal disc at the bottom of the hydranth rests, and beneath this, seemingly within the peduncle, is a delicate basal septum. The hydrothecæ are seldom set symmetrically upon their peduncles. Owing to the state of preservation, the structure of the hydranth could not be recognised. The tentacles appeared to be few in number.

Gonosome not known.

Localities. (*a*) St. Vincent, Cape Verde Islands: growing on specimens obtained from the bottom of a lighter; 30th July, 1904.—(*b*) Piles of pier: Porto Praya; 12th August, 1904.

The specimens from Porto Praya (only a few hydrothecæ have been found) are considerably larger than those from St. Vincent, but the specific structures in the two sets of specimens are identical (*cf.* fig. 5 and figs. 3 & 4, Pl. XXIII.).

This species approaches *Lafoëa pocillum* Hincks 1868, from which however it differs greatly in shape and in possessing an everted margin. From *Campanularia corrugata* Thornely 1904, it may be distinguished by its strongly-twisted peduncle, its campanulate shape, and its non-corrugated walls.

Family SERTULARIIDÆ.

SERTULARIA DISTANS * Lamouroux 1816.

A species represented by a few colonies growing upon a seaweed. The largest specimens are 7 mm. high, while the internodes

* In accordance with the recent determination of Dr. A. Billard (1907), who has had an opportunity of examining the type specimen of Lamouroux, I have substituted the designation of that author for the more usual synonym *S. gracilis* Hassall.

average 0·4 mm. in length. The hydrothecæ are free for rather more than half their height distally, the free portion being sharply divergent. The margin is divided into two lateral teeth, and there are two opercular flaps. The specimens agree closely with the descriptions and figures of Hincks (1868) and Nutting (1904).

Gonangia not present.

Locality. Porto Grande: shore-pools; ? July 1904.

Sertularia mayeri Nutting 1904.

Several specimens of this species have been obtained. The specimens agree in all respects with the description given by Nutting, except that in our forms, which are smaller than the American specimens—the maximum being about 7 mm.—the hydrothecæ appear to be rather more closely approximated, the length of an internode being only 0·6 mm. While in many cases the margin and operculum had collapsed, as described by Nutting, in others this portion of the hydrotheca retained its form, and two large lateral teeth, with sometimes a minute median superior tooth, and a two-flapped operculum could be distinguished.

Gonosome not known.

Localities. (*a*) Porto Grande, St. Vincent, Cape Verde Islands: creeping on seaweed found in shore-pools.—(*b*) On seaweed found by diving among coral in 2 fathoms of water: St. Vincent, 22nd July, 1904.

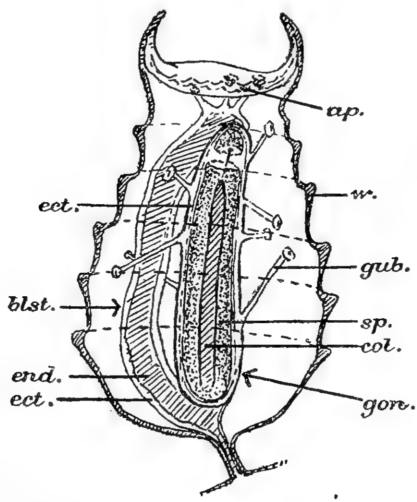
Sertularia versluysi Nutting 1904. (= *Desmoscyphus gracilis* Allman 1888.) (Plate XXIV. figs. 2, 3, 4, 5, 6, & text-fig. 144.)

A large number of colonies varying from 2 to 4 cm. in height. The stem is erect, unfascicled, and springs from a spreading mass of hydrorhiza. The lower portion of the stem for a distance varying from 3 to 10 mm. is smooth, thick-walled, and unbranched, and usually bears two straight internodes. The remainder, which is separated from the unbranched portion by a long, sloping, splice-like joint, is divided by slanting nodes into regular internodes about 0·7 mm. in length, each bearing three hydrothecæ—two on one side, one on the other. From beneath the lower of the two hydrothecæ the branches arise. They are about 4 mm. long, are regularly alternate, thus giving the colony a plumose appearance, and are divided into internodes, 0·4 mm. long, by nodes which slope from behind forward and downward. They are placed slightly on the front of the stem, and are borne on a long stem-process, but arise at an angle of 60° rather than at right angles as described by Nutting.

The hydrothecæ are placed on the front of stem and branches; on the former they are alternate and apart, while on the latter they are opposite, and contingent for the greater part of their length, the distal free portion being bent at right-angles to the adnate portion. The hydrotheca pairs are distant from one another about the height of a hydrotheca. The hydrothecæ, short and stout proximally, gradually narrow towards the opening, which is furnished with two long, thick-rimmed, lateral teeth. The operculum is composed of two flaps, in this agreeing with Nutting's description and differing from that of Versluys (1899, p. 43), where only a single flap is mentioned.

Gonosome.—The gonangia, which are characteristic, have not been previously described. They are 1 mm. high, borne on short stalks on the front of the stem, generally one on each internode, and arise from near the base of a hydrotheca. They are strongly compressed from back to front, somewhat flask-shaped, with their greatest diameter (0·6 mm.) near the base and gradually narrowing towards the top, where a slight neck is surmounted by a flattened disc bearing two long, incurved, horn-like spines. These are placed, one on each side, immediately above the longitudinal lateral ridge formed by the compression of the gonangium. The gonangia are strongly ridged throughout, the ridges varying in number from five to eight. The gonangial contents escape through a longitudinal slit with toothed edges, stretching along the flattened top of the gonangium from "horn" to "horn."

Text-fig. 144.



Male Gonosome of *Sertularia versluysi*.

ap., aperture with toothed lips through which gonangial contents escape; *w.*, wall of gonangium; *gub.*, gubernaculum; *sp.*, spermary; *col.*, central column of gonophore; *gon.*, gonophore; *ect.*, ectoderm; *end.*, endoderm; *blst.*, blastostyle.

A peculiar modification was noted in one of the specimens examined, where the distal and posterior portion of a branch-internode had become free and was prolonged into a straight sharp spine lying almost parallel to the continuation of the branch. The spiny appearance of the branch-bearing processes of the stem when denuded of their branches is also noteworthy (*cf.* Allman, 1888, p. 72).

Locality. Porto Praya, Cape Verde Islands: piles of pier; 12th August, 1904.

Other localities:—Off Bermuda, 30 fathoms ('*Challenger*'); Cape Verde Islands, 25 metres (*Versluys*); on floating gulf-weed ('*Albatross*'); N.W. of Cape Blanc (Soudan), in 55 to 60 metres (*Billard*, 1906).

In the colonies examined, the gonophores were all male and in an advanced stage of development. Their structures resemble those of *Sertularia pumila* as described by Nutting (1904, pp. 26 *et seq.*), but in most, owing perhaps to the advanced stage of the gonophore, the blastostyle is comparatively small, and in no case could be observed to terminate in a thickened plug or "Deckenplatte." On the other hand, delicate strands of ectoderm stretched from the outer coat of the gonophore to the gonangial wall, to which they were attached, thus mooring the gonophore within the gonangium. Nutting, who also has found similar "gubernacula" in a male gonangium but arising from a sperm-bearing blastostyle instead of from a true gonophore, suggests that they may connect the ectoderm of the blastostyle, or in this case of the gonophore, with a delicate ectodermal layer which in some cases lines the inside of the gonangial walls (Nutting, 1904, p. 29). In these specimens I have been unable to detect the presence of an ectodermic gonangial layer such as Nutting describes. He also suggests that they may possess the nutritive function attributed by Weismann (1883) to the gubernacula of "*Sertularia pumila.*"

Sertularia lævimarginata, sp. n. (Plate XXVI. figs. 5 & 6.)

Several minute colonies, less than 3 mm. in height, spring from a creeping hydrorhizal tube which ramifies over a polyzoon-encrusted frond. The stems are unfascicled and unbranched and are divided into distinct internodes, about 0·3 mm. long, which become much constricted in the neighbourhood of the nodes. The portion of the stem proximal to the first distinct node, which slopes at a high angle from back to front, is athecate, but each internode bears two opposite hydrothecæ towards its distal end.

The hydrothecæ rest upon a bulging portion of the internode and are somewhat ventricose, the bulging portions meeting on the front of the stem, but being slightly separated, for 0·01 mm., behind. For less than half their height they are adnate to the stem, but the distal portion (about 0·28 mm. in length) bends sharply outwards, so that the apparent upper sides form an almost straight horizontal line. The free portion becomes gradually constricted and tube-like towards the margin, which is smooth and is characterised by a shallow sinus on its upper edge, at the base of which is attached a disc-shaped adcauline operculum.

This operculum is frequently drawn within the hydrotheca. The aperture faces obliquely upwards.

The gonosome is absent.

Locality. Creeping upon a leaf found in one of the bottles containing Mr. Crossland's collection of tunicates from Mattiota, St. Vincent Harbour, Cape Verde Islands.

The peculiarly shaped hydrothecæ in the present specimen bear some resemblance to those of *Sertularia lucernaria* Kirchen. 1864; but in that species the aperture is almost horizontal, with a very distinct margin, the hydrothecæ are widely separated, and the colonies are branched, with a bushy habit of growth, altogether different from the minute, simple, and scattered colonies of *S. lævimarginata.*

Family PLUMULARIIDÆ.

PLUMULARIA HALECIOIDES Alder 1859.

This species is represented by a few specimens, attaining a maximum height of 2·5 cm., which agree closely with the description of Hincks (1868). The following variations from and additions to that description were noted:—The branches, which are rare and may arise on any side, spring in the specimens examined, not from the original hydroclade-bearing tube, but from one of the secondary tubes of the stem-fascicle; the hydroclades bear up to six hydrothecæ in place of Hincks's maximum of four; intermediate athecate internodes are not always present between thecate internodes, thus in 100 internodes examined only 31 were athecate and intermediate, a pair of the latter rarely occurring together; the gonangia, for the most part strongly ringed, occur not only on the stem but also on the hydrorhizal tubes. Similar variations have been noted by Billard (1904, pp. 181 *et seq.*) in specimens from the French coast and from Algeria.

Locality. St. Vincent, Cape Verde Islands: growing on the bottom of a lighter; 20th July, 1904. Also found on 22nd July, 1904, by diving among coral in a depth of 2 fathoms.

MONOSTÆCHAS QUADRIDENS (McCrady 1857). (Plate XXV. fig. 4.)

Two colonies have been referred to this species. They differ markedly in size and habit from the flabellate, dichotomously branched, 6-inch high specimens described by Nutting (1900, p. 75); for they are unbranched and but 1 cm. in height. Nevertheless the minute structure agrees so closely with Nutting's descriptions and figures, that I cannot regard these specimens as specifically distinct. I noted, however:—(1) The peculiar manner in which the hydroclades arise from the stem. The distal portion of the stem-internode bends over towards the anterior aspect of the stem, and to the end of this bent portion the hydroclade is attached by a slanting node; while from the posterior portion of the bend a second stem-internode arises, at an angle with the first. Each hydroclade lies in a line with the stem-internode from which it arises, and from the posterior aspect of which the succeeding stem-internode is thrown off at an angle (Pl. XXV. fig. 4). The structure of the colony thus comes to resemble that of a helicoid cyme. (2) An unprotected sarcostyle, not mentioned by Nutting, issues from the angle between the hydrotheca and its internode. The arrangement of the nematophores agrees with that in Nutting's figure, pl. xiii. fig. 2, except that the supracalycine nematophores more closely resemble those in fig. 4, scarcely reaching the margin of the hydrotheca. On the stem-internodes, of which there are only four in our largest specimen, the nematophores vary from 3 to 5.

Gonosome not present.

Locality. St. Vincent, Cape Verde Islands, 15 fathoms; 30th July, 1904.

In the collections made by Professor W. A. Herdman, F.R.S., in connection with the Gulf of Manaar Pearl Fisheries Investigations, small specimens of this species occur similar in size to those above described—" half an inch is the height of the largest colony " (Thornely, 1904, p. 120).

Aglaophenia marginata, sp. n. (Plate XXIV. figs. 7, 8, 9, 10.)

Slender, monosiphonic colonies reaching a height of 6 cm. The normal condition of the colonies is simple, for in only one specimen was a branch found, springing from the anterior surface of the stem. The stem is divided into internodes, 0·5 mm. in length, each bearing a hydroclade on a prominent, rounded and perforated process lying midway between the nodes. The hydroclades are short, generally less than 3 mm., set forward on the stem, alternate, and divided into internodes 0·35 mm. long, each of which bears a hydrotheca. Two internodal septa are present, one proximal and opposite the intrathecal septum and extending completely around the internodal wall; the other distal and less pronounced, opposite the base of the supracalycine nematophores, and sloping slightly upwards.

The hydrothecæ are small, 0·25 mm., closely approximated and rather deep, with a concave anterior profile, and a slightly oblique margin marked by nine teeth, which increase in size towards the anterior of the calycle. A distinct, horizontal septum traverses the hydrotheca cavity about a fifth from the base. The supracalycine nematophores are small, just reaching the level of the hydrotheca margin. The mesial nematophore is adnate for little more than half the height of the hydrotheca, and has but a short divergent " beak " free. There are two nematophores on each stem-internode, one opposite, the other distal to, the hydroclade-bearing process.

The stem is of a horny-brown colour, which fades into a faint yellow towards the tip.

Gonosome.—The corbulæ are about 1·7 mm. in length by 1 mm. in breadth, elongate-oval in shape, with 7 or 8 pairs of corbula-leaves, which are altogether free from one another. Every leaf bears a row of 6 or 7 large bulging nematophores on each margin. The cœnosarc from which the portions supplying these nematophores branch off runs up one side of the leaf, sending off as it passes a short process into each nematophore on that side, and then, having passed a considerable distance up the leaf, sends off a larger shoot which, running backwards, supplies the nematophores along the other side. Conforming with this branching of the cœnosarc, the cœnosarc-containing cavity in the leaf also shows a backward-running branch connected with the nematophore-cavities along one side (*vide* Pl. XXIV. fig. 10). Without the walls of this cavity there is a delicate chitinous membrane connecting the nematophores and forming a wing-like extension to the body of the leaf proper. The specific name *marginata* indicates the presence of this extension. At the base of each leaf along only one side of the corbula there is a very small spur-like nematophore.

Locality. Growing on the bottom of lighters: St. Vincent, Cape Verde Islands; 20th and 30th July, 1904.

LYTOCARPUS GRANDIS, var. UNILATERALIS, var. n. (Plate XXV. figs. 1, 2, 3.)

Many much-branched colonies have been obtained from one locality: the largest, which is fragmentary, is 20 cm. in height, with a stem 6 mm. in diameter above the first branch, and a large basal portion covered with loose hydrorhizal tubes.

The stem is strongly fascicled and is divided near the base into several large branches, which bear smaller branches and so on sometimes to the sixth order. All the branches, except the smallest, spring from their parent branch on the side remote from the stem, a rather unusual arrangement to which the variety owes its name. The hydroclade-bearing tubes are divided into regular internodes, 0·4 to 0·5 mm. in length, each of which bears an alternate hydroclade almost on its anterior surface.

The hydroclades, which are borne on a perforated process of the internode, are about 8 mm. long, and are divided into internodes 0·35 mm. in length, each with two very strong septal ridges, one opposite the intrathecal ridge and horizontal, the other less distinct opposite the base of the lateral nematophores and sloping obliquely upwards.

The hydrothecæ are closely approximated, deep, slightly bulging below, with nine teeth, seven of which are apparent while one on each side is hidden by the lateral nematophore. The anterior tooth is slightly recurved. The intrathecal ridge is distinct and is horizontal, extending around the hydrotheca about $\frac{1}{5}$ from the base. The mesial nematophores are long, adnate almost to the top of the hydrotheca and then free for some distance. The free portion varies much in length, sometimes scarcely rising above the hydrotheca on the proximal end of a hydroclade while overtopping those on the distal portion for a considerable distance (*cf.* Pl. XXV. figs. 2 & 3). In the supracalycine nematophores the same variability occurs, those on the proximal hydrothecæ rising just clear of the margin, those in the distal produced into long, prominent "horns" reaching 0·1 mm. beyond it. They have two apertures, one terminal, the other lateral and just above the hydrotheca margin. The cauline nematophores, of which there are two on each hydroclade-bearing internode, one on a level with, the other proximal to, the base of the hydroclade, are large, from 0·1 to 0·2 mm. in height, and triangular.

The colonies are of a rich dark brown colour which, however, is almost lacking in the more delicate hydroclades.

The gonosome is not present.

The specimens here described, although they differ from *L. grandis* (Clarke, 1879) in their unilateral mode of branching, agree so accurately with the minute structure of hydrotheca and branch as described and figured by Versluys (1899, p. 51), that they have been referred to that species. The black granular pigment-cells observed by Nutting (1900) in the cœnosarc of *L. grandis* and *L. clarkei* are present in considerable numbers in my specimens. The branching here described is similar to that of *L. racemiferus* of Allman (1883), but the specimens differ in the greater length of the hydroclades, the bulging shape of the hydrothecæ, the number of marginal teeth (apparently only five in Allman's figures), and the presence of a distal internodal septum. Allman does not mention the presence of cauline nematophores in his species.

Locality. St. Vincent, Cape Verde Islands: depth 15 fathoms; 30th July, 1904.

Lytocarpus crosslandi, sp. n. (Plate XXIV. fig. 11; Plate XXVI. figs. 2, 3, 4.)

Colonies unbranched, springing from a creeping hydrorhiza and attaining a height of about 15 mm. The stem is monosiphonic, divided into regular internodes 0·3 mm. in length, except the proximal millimetre which is undivided, and which is separated from the remainder by a deep constriction sloping downwards from posterior to anterior. The hydroclades, which are borne on each internode, are placed anteriorly on the stem and are approximate and alternate. They are divided into regular internodes 0·25 mm. long, each of which bears on its anterior surface a hydrotheca, and contains two septal ridges, one opposite the intrathecal ridge, the other under the lateral nematophores. In no case was a third septum, between the other two, observed.

The hydrothecæ are closely approximated, and are marked in front by a deep fold which brings the aperture into a vertical position. The margin has anteriorly a strong, sharp, upturned tooth and on each side a prominent lobe, while the interior is divided into two regions by an intrathecal ridge projecting forwards from the internode about 0·5 mm. from the bottom. A second stout intrathecal ridge projects backwards into the hydrotheca from between the mesial nematophore and the margin.

The mesial nematophore is long (almost 0·3 mm.), reaching 0·05 mm. above the level of the hydrathecal margin, adnate for little more than half its length, and with two apertures. The supracalycine nematophores are divergent, long and tubular, inclined at an angle similar to that of the mesial nematophore. and rising a short distance above the margin of the hydrotheca, to which they are adnate. On each stem-internode there are two triangular nematophores, one proximal, the other distal to the base of the hydroclade, while the base itself bears anteriorly a tubular nematophore.

Gonosome.—The gonangia are borne on modified recurved hydrocladia, divided into about ten short internodes, the proximal bearing a hydrotheca, which is replaced on the following two or three internodes by a gonangium. Each of the remaining internodes bears one or two divergent tubular nematophores, each with two apertures, one terminal, the other in the angle formed between nematophore and internode. The gonangia are almost circular, and are much compressed. As many as twenty-two gonangia on eight phylactocarps were counted on one specimen. The arrangement of the nematophores on the phylactocarp suggests that which occurs in connection with the hydrothecæ, two divergent nematophores frequently occurring at the same level and beneath them a single mesial nematophore.

Locality. Growing on a leaf found in a bottle containing tunicates from Mattiota, St. Vincent Harbour.

The trophosome of the present species is almost identical with that of *Aglaophenia plumosa* Bale (1884), but there the recurved gonangial pinna bears "15–20 pairs of alternate pinnules," these again bearing the nematophores which are arranged differently from those in the specimen before me, the whole structure forming a corbula.

List of Literature cited.

Alder, J., 1859.—"Description of two new Species of Sertularian Zoophytes, found on the coast of Northumberland"; Ann. Mag. Nat. Hist. 3rd ser. vol. iii.

Allman, G. J., 1864.—"Notes on the Hydroida"; *ibid.* 3rd ser. vol. xiv.

Allman, G. J., 1871, 1872.—A Monograph of the Gymnoblastic or Tubularian Hydroids. Ray Society. London.

Allman, G. J., 1877.—"Report on the Hydroida collected during the exploration of the Gulf Stream." Harvard Mus. Zool. Mem. 5.

Allman, G. J., 1883.—"Report on the Plumularians." 'Challenger' Expedition, Sci. Reports, Zool., vol. vii.

Allman, G. J., 1888.—"Report on the Hydroids," Part II.; *ibid.* vol. xxiii.

Bale, W. M., 1884.—A Catalogue of the Australian Hydroid Zoophytes. Sydney.

Beneden, P. J. van, 1844.—"Recherches sur l'Embryogénie des Tubulaires"; Nouv. Mém. de l'Acad. de Brux., tome xvii.

Billard, A., 1904.—"Contributions à l'étude des Hydroïdes"; Ann. des Sci. Nat. sér. 8, vol. xx.

Billard, A., 1906.—"Hydroïdes: Mission des Pècheries de la Côte Occidentale d'Afrique"; Actes Soc. Linn. de Bordeaux, vol. lxi.

Billard, A., 1907.—Hydroïdes: Expéditions scientifiques du 'Travailleur' et du 'Talisman,' tome viii.

Clarke, S. F., 1879.—Bull. Mus. Comp. Zool. Harv. Coll., vol. v. no. 10.

Delage, Y., 1901.—Traité de Zoologie Concrète, tome ii. part. 2. Les Cœlentérés.

Ehrenberg, C. G., 1832.—"Beitrag zur phys. Kenntniss der Corallenthiere im Allgemeinen und besonderes des Rothen Meeres"; Abh. der Berlin. Akad.

Ellis, J., & Solander, D., 1786.—The Natural History of many curious and uncommon Zoophytes collected from various parts of the Globe. London.

Fowler, G. H., 1900.—The Hydromedusæ: in 'A Treatise on Zoology,' edited by Prof. E. Ray Lankester, Part II.

Hartlaub, Cl., 1905.—"Die Hydroiden der magalhaenischen Region und chilienischen Küste"; in Fauna Chilensis—Suppl. vi. to Zoolog. Jahrbücher.

Hassall, A. H., 1852.—Trans. Micr. Soc. vol. iii.

Hincks, T., 1863.—Ann. Mag. Nat. Hist. 2nd ser. vol. xi.

Hincks, T., 1866.—*Ibid.* vol. xviii.

Hincks, T., 1868.—A History of the British Hydroid Zoophytes. London.

Johnston, G., 1838.—A History of British Zoophytes. Edinburgh.

Kirchenpauer, G. H., 1864.—"Ueber neue Sertulariden." Acta Ac. German. xxxi. pp. 1–16.

Lamarck, J. de, 1816.—Histoire naturelle des animaux sans vertèbres, vol. ii. Paris.

Linnæus, 1758.—Systema Naturæ, ed. 10.

Lovén, S., 1835.—"Bidrag till kännedomen af slægterna *Campanularia* och *Syncoryna*"; Handl. Svensk. Akad. Stockholm.

McCrady, J., 1857.—Proc. Elliott Society, April 1857.

Nutting, C. C., 1900.—"American Hydroids." Part I. Plumularidæ; in Special Bull. Smithsonian Institution.

Nutting, C. C., 1904.—*Ibid.* Part II. Sertularidæ. *Ibid.*

Pictet, C., 1893.—"Etude sur les Hydraires de la Baie d'Amboine"; Rev. Suisse Zool. vol. i.

Quelch, J. J., 1885.—"Deep-sea and Shallow-water Hydrozoa"; Ann. Mag. Nat. Hist. 5th ser. vol. xvi.

Ritchie, J., 1907.—"Hydroids of the Scottish National Antarctic Expedition"; Trans. Roy. Soc. Edinburgh, vol. xlv. part 2.

Sars, M., 1851.—"Beretning om en Zoolog.-Reise in Lofoten og Finmarken"; Nyt Mag. Naturvid. vol. vi.

Thornely, Laura R., 1904.—"Hydroida"; in Report on the Pearl Oyster Fisheries of the Gulf of Manaar, by Prof. Herdman, F.R.S. Suppl. Rep. vol. viii. Roya Soc. London.

Versluys, J., 1892.—"Hydraires Calyptoblastes recueilles dans la mer des Antilles"; Mém. de la Soc. Zool. de France, tome xii.

WARREN, E., 1906.—"On *Tubularia solitaria*, sp. n., a hydroid from the Natal Coast"; Annals of the Natal Gov. Mus., vol. i. part 1.

WEISMANN, A., 1883.—Entstehung der Sexualzellen bei den Hydromedusen. Jena.

EXPLANATION OF THE PLATES.

PLATE XXIII.

Fig. 1. *Coryne* (?) *dubium*, sp. n. A complete colony to show abundance of branching. × 4. (p. 491.)
2. *Coryne* (?) *dubium*, sp. n. Fragment, showing polyps and origin of branches. × 30. (p. 491.)
3. *Campanularia mutabilis*, sp. n. Specimen from St. Vincent, with regenerated margin. × 20. (p. 504.)
4. *Campanularia mutabilis*, sp. n. Specimen from St. Vincent, showing asymmetry. × 20. (p. 504.)
5. *Campanularia mutabilis*, sp. n. Specimen from Porto Praya. × 20. (p. 504.)
6. *Hydractinia verdi*, sp. n. Portion of colony with polyps in various states of contraction. × 20. (p. 498.)
7. *Hydractinia verdi*, sp. n. Reproductive person bearing gonophores with ova. × 50. (p. 498.)
8. *Podocoryne anechinata*, sp. n. Portion of colony with nutritive and reproductive person. × circ. 30. (p. 499.)
9. *Podocoryne anechinata*, sp. n. Medusoid before it is set free. ×90. (p. 499.)
10. *Podocoryne anechinata*, sp. n. Chitinous tubes forming mesh-like basal expansion. × 25. (p. 499.)
11. *Ophiodes caciniformis*, sp. n. Colonies creeping upon fragment of worm-tube. Nat. size. (p. 500.)
12. *Ophiodes caciniformis*, sp. n. General structure of colony. × 15. (p. 500.)

PLATE XXIV.

Fig. 1. *Ophiodes caciniformis*, sp. n. Hydranth, hydrotheca nematophore, &c. × 40. (p. 500.)
2. *Sertularia versluysi* Nutt. Cluster of colonies. Nat. size. (p. 505.)
3. ,, ,, Fragment of colony showing arrangement of branches. × 14. (p. 505.)
4. ,, ,, Hydrothecæ from front. × 50. (p. 505.)
5. ,, ,, Hydrothecæ from side. × 50. (p. 505.)
6. ,, ,, Gonangia. × 25. (p. 505.)
7. *Aglaophenia marginata*, sp. n. Colonies. Slightly reduced. (p. 509.)
8. ,, ,, Hydrothecæ. × 50. (p. 509.)
9. ,, ,, Corbula. × 40. (p. 509.)
10. ,, ,, Leaf of corbula. × 70. (p. 509.)
11. *Lytocarpus crosslandi*, sp. n. Colonies on leaf. Nat. size. (p. 511.)

PLATE XXV.

Fig. 1. *Lytocarpus grandis*, var. *unilateralis*, var. n. Fragment of colony showing mode of branching. Nat. size. (p. 510.)
2. *Lytocarpus grandis*, var. *unilateralis*, var. n. Hydrothecæ from base of a hydroclade. × 50. (p. 510.)
3. *Lytocarpus grandis*, var. *unilateralis*, var. n. Hydrothecæ from tip of a hydroclade. × 50. (p. 510.)
4. *Monostæchas quadridens* (McCrady). Showing cyme-like origin of stem-internodes. × 20. (p. 508.)
5. *Ophiodes caciniformis*, sp. n. Protruded nematocyst. × 700. (p. 501.)

PLATE XXVI.

Fig. 1. *Soleniopsis dendriformis*, gen. et sp. nov. Colony. Nat. size. (p. 495.)
2. *Lytocarpus crosslandi*, sp. n. Phylactocarp, with single gonangium. (p. 511.)
3. ,, ,, Phylactocarp. × 45. (p. 511.)
4. ,, ,, Hydrothecæ. × 60. (p. 511.)
5. *Sertularia lævimarginata*, sp. n. Colonies on a leaf. Nat. size. (p. 507.)
6. ,, Hydrothecæ. × 60. (p. 507.)

June 18, 1907.

G. A. Boulenger, Esq., F.R.S., Vice-President, in the Chair.

The Secretary read the following report on the additions that had been made to the Society's Menagerie in May 1907 :—

The registered additions to the Society's Menagerie during the month of May were 220 in number. Of these 103 were acquired by presentation and 37 by purchase, 68 were received on deposit, 3 in exchange, and 9 were born in the Gardens. The total number of departures during the same period, by death and removals, was 208.

Amongst the additions special attention may be directed to :—

An Elegant Mongoose (*Galidia elegans*) and a Broad-banded Mongoose (*Galidictis striata*), the latter new to the Collection, from Ambinaninbrano, E. Madagascar, presented by Archdeacon Kestell-Cornish on May 28th.

Two Capybaras (*Hydrochœrus capybara*) and a Brazilian Tapir (*Tapirus americanus*) from Venezuela, presented by Mr. H. G. O. Bax-Ironside on May 30th.

A pair of Indian Onagers (*Equus onager indicus*) from Bokhara and N. Khorassan, presented by Capt. Keyes on May 7th.

A Black-gloved Wallaby (*Macropus irma*), two Cervine Kangaroos (*M. cervinus*), two Owen's Kangaroos (*M. magnus*), and two Woodward's Kangaroos (*M. woodwardi*), the last two species new to the Collection, from Australia, deposited on May 3rd.

A Collection of Birds from Venezuela, including 13 Felicia's Humming-birds (*Amazilia feliciæ*), a Blue-chinned Humming-bird (*Eucephala cærulea*), two Ruby-crested Humming-birds (*Chrysolampis moschitus*), three Prevost's Humming-birds (*Lampornis prevosti*), a Shining Tanager (*Calliste vitreolina*), and an Orange-browed Tanager (*Euphonia elegantissima*), new to the Collection, presented by Messrs. A. and H. Pam on May 27th.

An Owl-Parrot (*Stringops habroptilus*) from New Zealand, deposited on May 28th.

Two cocks and a hen Great Bustards (*Otis tarda*) from Spain, presented by Mr. W. J. Buck, C.M.Z.S., on May 6th.

Mr. C. J. Gahan exhibited a remarkable luminous insect recently presented to the British Museum by Mr. J. Kempthorne, of Great Crosby, near Liverpool, who brought it alive from Manaos in Brazil. Perfectly larva-like in form, nearly an inch and a half long, mostly of a creamy-yellow colour, but with the head and anal segment of a darker, reddish-brown tint, the insect glowed with a rich fire-red light from the head and fore part of the first body-segment, while it had a pair of bright green lights on each of the following segments except the last—11 pairs in all. The anal segment, much narrower than the others and used as a support in walking, was the only segment of the body that was not luminous. The green lights were placed near the hind margins of the segments—those on the penultimate segment close to the median dorsal line, the others at the sides. Luminous, larva-like insects similar to this one were known in America since the beginning of the nineteenth century, but were met with only at rare intervals, and for a long time were supposed to be the larvæ of *Pyrophorus* or some other genus of Elateridæ. Not until 22 years ago were they first definitely ascertained to belong to the *Phengodini*, a group of Malacoderm beetles allied to the glowworms. The males of this group are ordinary winged beetles, with well-developed plumose antennæ, and rather short, narrow, wing-cases; they are slightly luminous from one or more of the sternites of the abdomen. The females, apart from their greater luminosity, are of especial interest, inasmuch as they are more larva-like than any other known beetles; they retain not only the general form but all the external features of the larva, including short, four-jointed antennæ provided with a sensory organ like that of the larva, simple eyes, and five-jointed legs ending each in a single claw; they apparently differ from the larva only in having somewhat shorter jaws and shorter tarsal claws. It was impossible, therefore, to say whether the specimen exhibited was an adult female or only a well-grown larva. It agreed very well on the whole with the figure and description of the female of *Phengodes hieronymi* Haase *, but was ~~not so large~~, was less hairy, and had one pair more of green lights—the pair situated near the middle line on the penultimate segment.

Mr. H. O. Bax-Ironside, H.M. Minister to Venezuela, exhibited a series of 18 models of Venezuelan Animals. The models had been made from living specimens by a native Indian, the material employed being Ballata gum.

Mr. C. L. Boulenger exhibited and made remarks on a new Hydromedusan of which examples of both polyp and medusa stages were obtained by Dr. Cunnington and himself during their recent exploration of the lake Birket Qurun in the Fayum.

The medusa, for which Mr. Boulenger proposed the name *Moerisia lyonsi*, g. & sp. n., was an Anthomedusan which appeared closely related to *Sarsia*.

The hydroid was gymnoblastic and resembled *Cordylophora*, differing, however, from that genus in possessing a more complex mode of branching, and in the situation of the gonophores, which were on the polyps themselves.

Mr. R. I. Pocock, the Superintendent of the Gardens, exhibited two young English Squirrels (*Sciurus vulgaris albicauda*) showing

* Deutsche Ent. Zeit. xxxii. (1888).

an abnormal change in the colour of the fur. The Squirrels, which had been reared by a domestic cat, were presented to the Society by Mr. A. Heneage Cocks, F.Z.S., and had been exhibited in the Gardens with their foster-parent and one of her kittens. When received at the beginning of May, they were just strong enough to crawl feebly and were well covered with their first coat of fur, which was of the rich ruddy-brown hue characteristic of the new coat in ordinary English Squirrels. A week or two later, when they were sufficiently active to climb about the cage, it was noticed that the fur was gradually losing its colour and turning grey. The change was effected with tolerable uniformity all over the head, tail, and body, with the result that by June 18th the animals were of a silvery-grey tint. On the feet and along a narrow strip bordering the white of the belly the red persisted longest. Ultimately the feet also turned white, but on the ventral area, especially on the inner side of the thigh, some red hair underwent no alteration in colour. The change was accomplished without any sign of alteration in the thickness, length or quality of the coat; nor was there any other evidence of moulting. In fact, careful watching of the process left very little doubt that the greyness resulted from the fading away of the red pigment in the individual hairs.

[During the three weeks that followed the exhibition of these Squirrels before the Society, the fur lost a good deal of its silvery lustre and became somewhat duskier, apparently from soiling; but no further change in the colour took place except the fading of the feet above alluded to. By the middle of July there was evidence of the recovery of the colour natural to the species. This showed itself first on the head and tail. The tail began to look thin and meagre from the dropping of the hair; and the hairs that were shed were gradually replaced by others of a dark-brown hue, the distal darkening before the proximal portion. Similarly on the head, the greyish-white hairs were moulted and replaced by reddish-brown hairs; but on this region the coloured area, beginning on the forehead and nose, gradually spread backwards over the nape, encroaching upon the greyish-white area and being marked off therefrom by a sharp line of demarcation. That the greyish-white hairs did not themselves become pigmented and turn dark was shown by the circumstance that they were longer than the coloured hairs.

No explanation could be offered either for the loss of the colour in the hair or for the midsummer moult of the faded hair. The only abnormal feature in the history of the Squirrels was their nurture on Cats' milk instead of on Squirrels' milk. There was conceivably a connection between the unusual food and the condition that caused the canescence or fading of the hair.]

The following papers were read:—

1. On the Growth-forms and supposed Species in Corals.

By Frederic Wood Jones, M.B., F.Z.S.

[Received June 15, 1907.]

(Plates XXVII.–XXIX.* and Text-figures 145–161.)

Before anyone engaged in the study of living creatures attempts to classify or arrange his material, it is essential that he should first observe, to the best of his ability, the life-processes of those creatures the affinities of which he would determine.

The zoology that deals with living animals must handle its material for study as living entities, it must observe the animals in their natural surroundings, must see the widest possible extent of their variation, and mark every influence of changing environment on the creature, before a cataloguing or an ordering of genera and species is undertaken. There should be no studying of living animals from fragments, as though they were creatures long since extinct.

I think it is true to say, that of all classes of animals the corals have suffered most injustice at the hands of zoologists, by reason of their being studied as fragments, and far from the site of their natural environment. It is also true to say that the collecting and describing of fragments of the vegetative growths of corals can lead only to confusion, for the conditions of the environment that produced the special characters of the fragment must always be carefully inquired into.

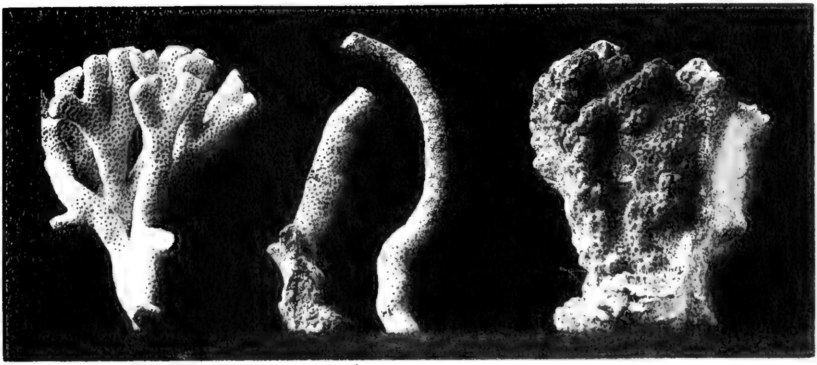
The corals constitute a chaotic collection of individuals, and the uncertainty as to what may be considered as a species is the first problem that must confront anyone who happens to study corals from his own resources on an isolated coral-reef. A gradually acquired familiarity with the actively growing corals in their natural habitat produces a gradual change in the standpoint from which a student would regard the limits of specific range; and a regular transition of ideas is undergone, from an early stage in which the number of species is believed to be limitless, to a final stage when the enormous variation in response to environment is recognised, and the actual species are known to be but few.

I am convinced that the only real advance that is likely to be made in the knowledge of a class of animals such as the reef-corals, must be the outcome of actual observation on the living colony; and the entire aim of my fifteen months' residence on the Cocos-Keeling atoll was the watching of the coral-growths in the endless variations of their natural environment.

I would urge that if these observations have but little scientific value, yet they have this merit, that anyone without special knowledge, but with a love of Nature, may extend and repeat them; and I believe that along these lines lies the interest of corals.

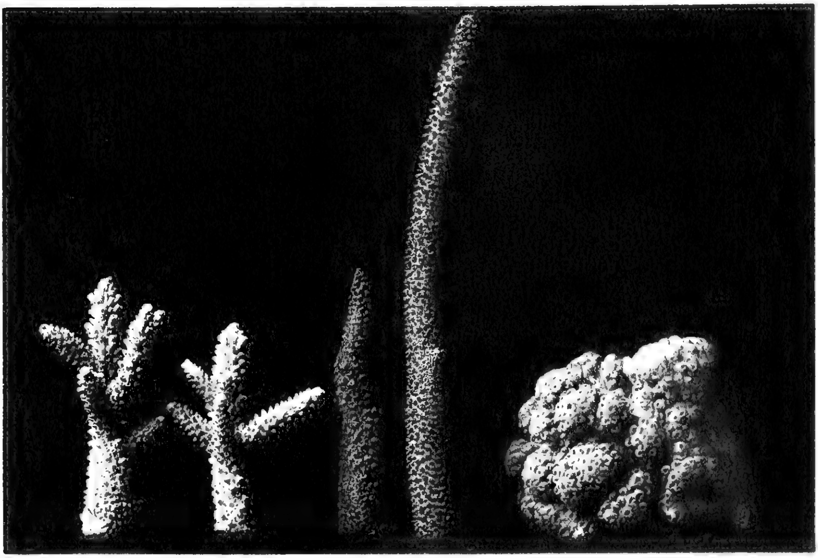
* For explanation of the Plates, see p. 556.

1



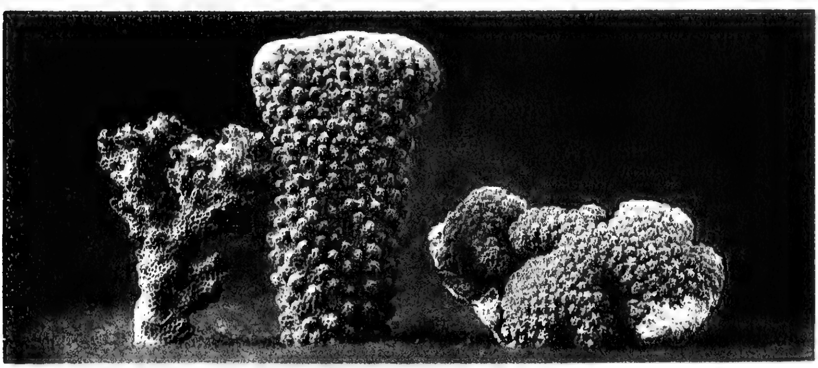
a b c

2



a b c

3

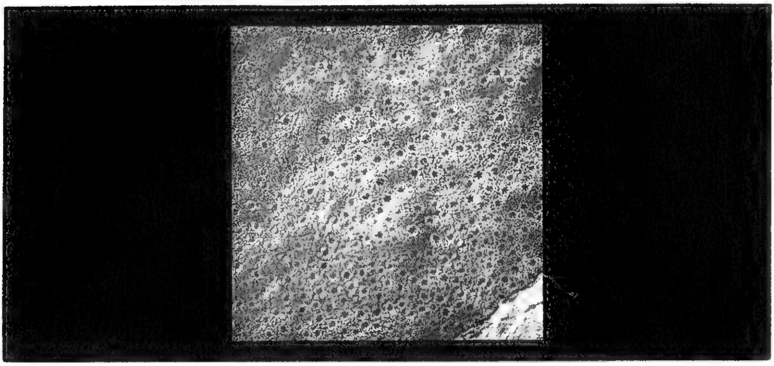


a b c

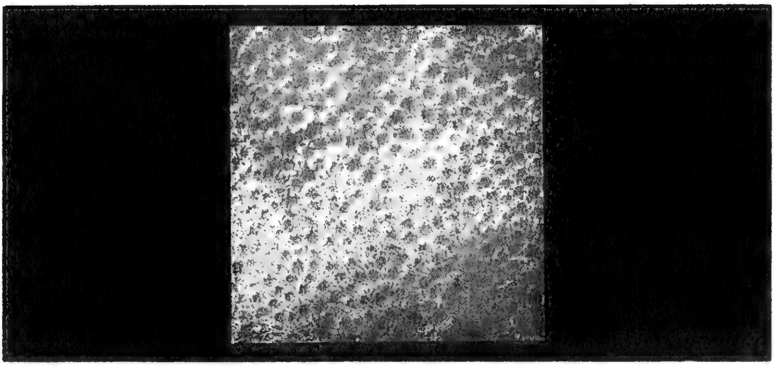
London Stereoscopic Co. imp.

INFLUENCE OF ENVIRONMENT ON CORALS

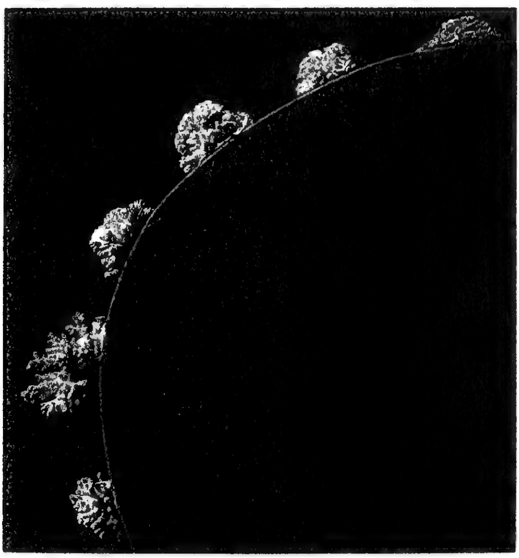
1



2



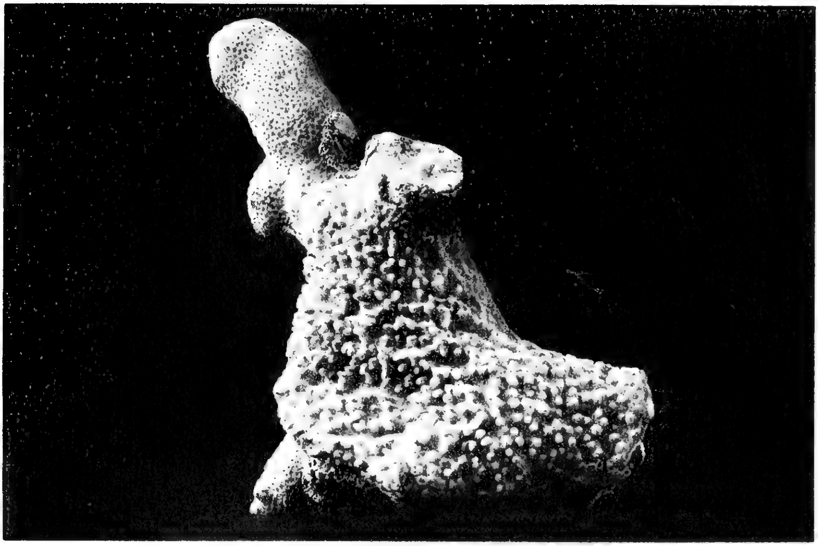
3



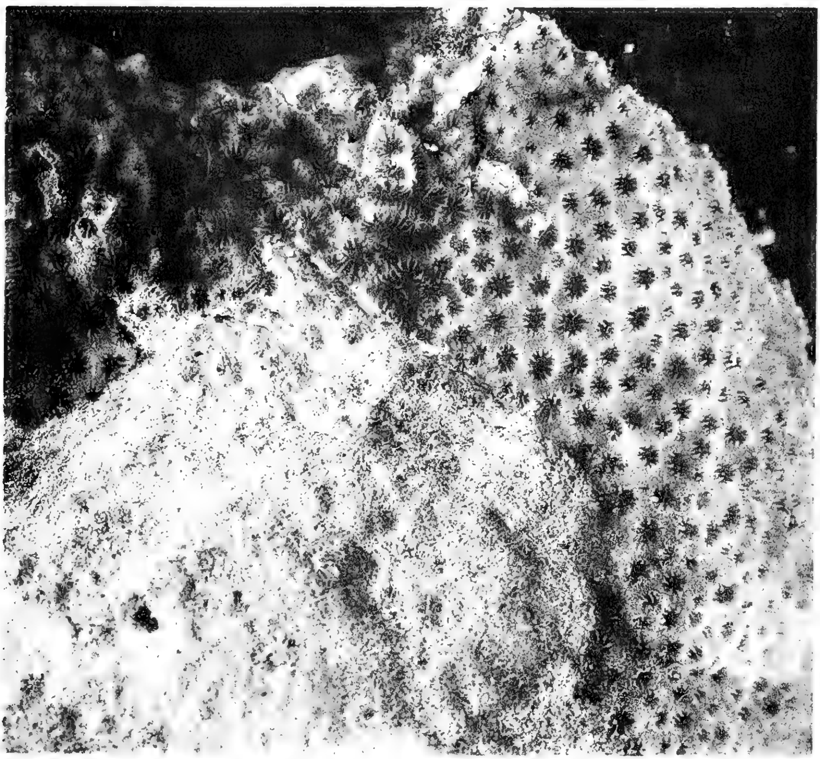
London Stereoscopic Co imp

INFLUENCE OF ENVIRONMENT ON CORALS.

1



2



London Stereoscopic Co imp

REPAIR AND DEATH IN CORALS.

The modern literature of corals and the modern methods of their study are devoid of interest, except to the museum specialist; and of those people whose lot is cast in places where excellent opportunities of study are at hand, many are prevented from making useful observations, by the wonderful maze of man-made difficulties that surrounds the study of a class of really interesting animals.

So as to introduce some order into the arrangement of the material collected and observed in the Cocos-Keeling group, it will be best to follow the life of the growing coral in its natural surroundings. The early stages need be touched on but lightly, and for all practical purposes the life of the colony may be considered to start with the fixation of the young larva. It is well known that the hollow, and as yet entirely uncalcified larva is expelled from the central cavity of the brooding parent, and in company with many hundreds of its kind is shot out into the water to take its chances of the tides and currents. It will at once be seen how varied may be the fortunes of the young coral, and how each individual embryo, endowed with its inherent growth-tendency, has a wide range of chance resting-places, that may happen to be suitable or not.

Every coral embryo launched into the world must start its career by becoming fixed to some nucleus, upon which it may build its future colony; and the nature of the nucleus, and its situation, though necessarily the outcome of the merest chance, are the determining factors in shaping the after destinies of the colony.

Coral embryos will become attached to almost anything in the water; they become fixed to older colonies, to shells, to dead coral masses, or even to floating pieces of wood; their resting place may chance to be of almost any shape, and to be situated in almost any environment. Now when the young coral starts its division, both the shape and the site of the nucleus are capable of modifying its method of division.

The asexual reproduction of corals is carried out by the division of the parent zooid, and the various methods by which this division is effected differ from each other considerably; and it is necessary to touch briefly upon the chief methods by which a zooid reproduces itself.

It is as well to state at the outset, and thus avoid much further explanation, that the different methods of division, though highly characteristic of certain well-marked types of growth, are not definitely and unalterably fixed; and I think it is justifiable to dogmatise, and state that *any form of coral may exhibit any form of division.* Since the resulting form of vegetative growth is purely the outcome of the type of division adopted by the zooid, then it follows that coral colonies may grow in many vegetative forms; and, again, these vegetative forms are not definitely fixed, for as any form of coral may exhibit any form of division, it follows that any form of coral may also exhibit any form of vegetative growth.

Speaking quite broadly, a colony may grow according to five different types of vegetative growth. It may grow as (1) a spherical mass, (2) an encrusting layer, (3) a free plate, (4) a branching tree-like growth, or (5) a mere amorphous lump; and though a definite inherent growth tendency is strongly implanted in the embryo, still the demands of the environment may call forth any type of vegetative growth.

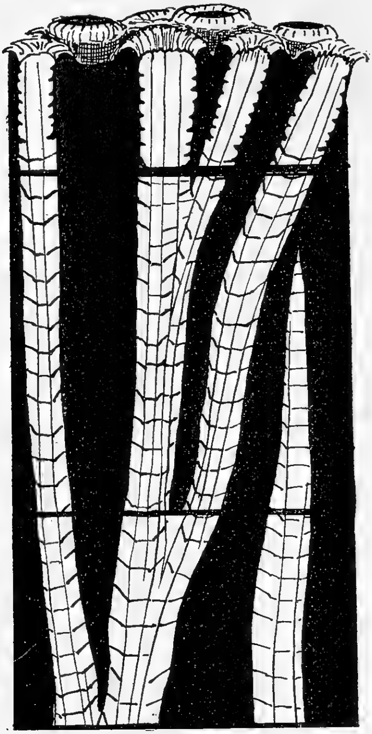
The growth-forms are purely the results of repeated divisions of the zooids, and so it will be seen that the relative value, from a reproductive point of view, of the zooids in a colony, is a thing of the greatest importance. This consideration brings in its train the division of all the colonial corals into two groups of normal growth-forms; for all the zooids may take an equal share in the asexual reproduction, or again, some may be of greater importance than others, and the asexual reproductive functions may be lodged in a very few individuals only. These two great divisions must be considered separately, for the rules that may be applied to their respective methods of growth are widely different.

Taking first the class in which every unit is of equal value, and going back to the earliest origin of the colony, it is easily seen that a zooid "A" settled on a nucleus will divide into zooids "B" and "C," and "B" will further divide into "D" and "E," and "C" into "F" and "G," and so on; each newly-divided individual taking its equal share in future divisions. The natural outcome of this state of things is that, if the site of election of growth be a prominence, or, as is not uncommon, a small isolated fragment, then the equal divisions will tend to form a spherical mass. The rapidly growing colony will tend to surround the nucleus on all sides, and in this manner are formed those rounded masses of *Porites* and *Astræopora* that are commonly to be found lying free in sandy pools, and which, when broken across, are seen to be formed around a central nucleus, that generally consists of a fragment of dead and altered coral.

It is of course but natural that the true spherical form cannot long survive in very large colonies, for the zooids growing below are of necessity killed by pressure. The mass will therefore become a hemisphere, and continue its growth as a rounded boulder. This boulder-form is a very common type of vegetative growth among the reef-building corals; for if the growth starts as a perfect sphere, it will ultimately assume this form, and if the colony starts its growth on a basis that is not an isolated fragment, it will start this mode of growth from its first beginning.

There are many different ways in which the asexual reproduction of the zooids is carried out, for the budding and division may proceed in various fashions. The principal types of budding vary from each other in the actual site of origin of the daughter zooid from the parent, and in the degree of the final separation of the two zooids. These types, I think, do not merit individual description here, for what was said previously is true for them all, and each, though highly characteristic as an inherent growth-form for a certain coral, may be assumed by many other corals.

Text-fig. 145.



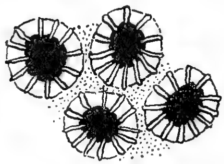
Vegetative reproduction in Corals.

Diagram to illustrate reproduction by equal budding: the transverse lines show the surface-level at the time when division took place.

One method of division that is important among corals with zooids of equal reproductive value, is the type characteristic of the Meandrinæ (text-figs. 149, 150). In these corals the complete separation of the divided zooids is never carried out by the calcareous partition-walls, and so a more or less linear series of zooid mouths is formed. Tentacles fringe the margins of this series, and the resulting skeleton exhibits those well-known fissure-like markings that have given museum specimens the name of "brain-corals."

Now even such a highly characteristic type of division as that of the Meandrinæ may be assumed by other corals; and as sports,

Text-fig. 146.



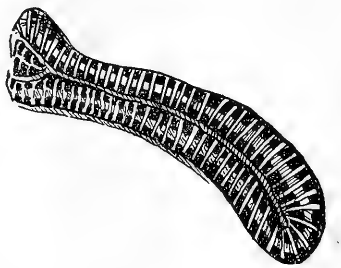
Text-fig. 147.

Vegetative reproduction in Corals.

Text-fig. 146.—Type in which the daughter zooids become completely separated.
Text-fig. 147.—Type in which separation of the daughter zooids is less complete.

Text-fig. 148.

Text-fig. 149.



Vegetative reproduction in Corals.

Text-fig. 148.—Further stage of incomplete separation of zooids.
Text-fig. 149.—Meandrine type of division.

Text-fig. 150.

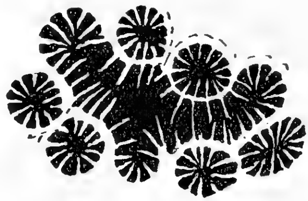
Vegetative reproduction in Corals.

Meandrine type of division: no separation of daughter zooids.

or even as localised patches in otherwise normal colonies, other corals may divide actively and yet form no calcareous partition-walls.

The meaning of these assumptions of an entirely foreign method of division is somewhat difficult to understand, but when an *Astrea* exhibits Meandrine fission, it is usually a sign that the colony is not flourishing and is in an unsuitable site; it would almost appear that the building of unnecessary partition-walls was too great an effort for the unhealthy zooids (text-fig. 151 and Pl. XXIX. fig. 2).

Text-fig. 151.



Vegetative reproduction in Corals.

Diagram showing an *Astrea* assuming (as a sport) a Meandrine form of division. From an actual specimen.

Again, the thickness of the intervening partition between two adjacent zooids is subject to endless variation, and in consequence the surface-pattern and the density of the coral may vary widely within the limits of a species. The same variation is to be seen in the level of the site of origin of the lateral buds, and this will have to be referred to later on, when the cause of the variations is considered.

Another feature that is subject to an excess of variation, and must therefore be considered, is the amount of raising from the general surface of each individual corallite. Every corallite of the colony may be flush with the general surface, or it may be raised from it in varying degrees, and the degree of raising gives very characteristic appearances to the colonies. The degree of elevation of the corallite is no safe criterion for determining specific rank, for it is a variable factor depending altogether on the reactions of the coral to its environment. The portions of the coral body that lie between the actual corallites are also important in this connection, for many characters that may have undue importance attached to them are displayed here. The interspaces may be smooth or rough, they may be sculptured in various fashions, and they may be elevated or depressed; but very great caution, and a very long study of the possibilities of variation, must be used by anyone who would assign specific rank to any of their forms.

Although a very large number of corals have the normal habit of reproducing equally from all parts of their surface, still evidences may be seen, at many points of most colonies, that certain groups of zooids are more active than their fellows.

The special activity of these zooids may be due to purely local causes; it may be called forth merely by irritation of a localised portion of the surface of the colony; or it may be a real alteration of vegetative habit. It is an outstanding fact about all the colonies observed for long intervals, that the growth tends to become irregular—at different times different portions of the colony have sudden phases of active growth, and these may be due to no observable cause. Again, some zooids of the colony may have special advantages due to the environment, and these zooids will grow and divide excessively, in such a manner that they dominate the growth of the whole colony, and consequently modify its form. The conditions of the environment may call forth special reproductive activity in any portion of the growth, and so in a colony, all of whose units are of equal importance, some part will be found to be growing onwards, whilst all the remainder of the zooids are practically at rest. In this way the typical hemisphere of such colonies may become modified as a creeping plate, an encrusting layer, a pseudo-branching form, or a mass of mere irregular nodules.

In those corals whose zooids are naturally of equal reproductive importance therefore, forms may arise, from physiological need, that simulate exactly those forms whose zooids are naturally of differing reproductive value.

Turning now to the corals that constitute the second class, and have some of their units specialised as active agents of growth, it is at once seen that the possibilities of variation of normal vegetative habit are greatly increased. All the elaborate branching forms, plates, and leaf-like growths belong to this class; and all are evolved by special peculiarities of the growing point. The zooids that constitute the growing point may take various forms: they may be arranged as a cluster, as a creeping edge, or as many varieties of terminal shoots of branches.

In the first instance, it is necessary to draw very sharp distinctions between two subdivisions of this group. In *Group* 1 come all those forms like *Montipora*, whose distal zooids are the newest formed members of the colony (text-fig. 152); and in *Group* 2 are included the Madrepores, whose distal zooid is the most ancient individual in the whole growth (text-fig. 153, p. 527).

In dealing with *Group* 1 many forms have to be considered, for when the youngest are the active cells their growth-cluster may be very variously disposed, and on its disposition the resulting vegetative form entirely depends.

When the growing cells are arranged in linear series, a flat growth will result, which grows from one of its edges, or from them all; and in this way an encrusting layer or a free plate may be formed. Corals that grow with a linear growing point may settle down on a basis, and spread over it in all directions, taking an exact impression of every irregularity of its contour; and then, reaching the limits of the basis, they may grow from it as flat plates, spreading out from its margins. Such corals as grow in this fashion show many curious changes at their free margins, for although the superior surface of the encrusting layer can alone produce zooids, still at the free edge zooids will appear on both superior and inferior surfaces.

In connection with these partial plates a very curious fact is always demonstrated, for the whole surface structure of the coral body, and of the corallites, differs above and below; and this important fact will need further reference. A coral may start from its first beginning by growing as free exfoliating plates, and then it may bear zooids on both surfaces of the plates, or on the upper surface alone. In every case where zooids are borne both above and below, there is the same marked difference of structure between the two surfaces.

Text-fig. 152.

Vegetative reproduction in Corals.

Diagrammatic section to illustrate the mode of growth of Montipores: the uppermost zooids are the most newly formed.

When the linear growing point grows uniformly upwards, the resulting growth consists of a series of vertical plates; and when the growth takes this form, the structure of both sides of the plate is identical, and zooids grow from both surfaces.

A plate-like growth is formed by a uniform and continuous growing edge; but the linear series of young growing cells may not maintain their continuity: the growing edge may reach a certain size and then divide, and the resulting growth consequently takes the form of a plate, cleft at its edges, or of a branching form, all of whose branches are given off in one plane. This is a highly characteristic form of growth of one type of Montipore that is abundant in the islands, and it grades very naturally into the plate-like growths on the one hand, and into the complicated branching forms on the other.

In the many highly branched forms of vegetative growth, the growing cells form a cluster, and this cluster divides as it grows upwards, with the development of many growing points at intervals on the parent stem. The cluster may be of various shapes, and its form determines that of the stem that results from it. The stem may be rounded or flattened, may be thin or thick, and it may branch at frequent intervals, or it may scarcely branch at all, so that straight rods of uniform thickness may be characteristic of the vegetative growth of the coral.

Another modification of this method of growth is that in which practically the whole colony represents the growing point, and then the entire mass grows upwards as a solid column; or the growing point may be confused and irregularly distributed, and then an irregular, lumpy amorphous mass results.

Whatever the vegetative growth may be, it is in these cases the product of a mass of growing cells, and these cells are being perpetually renewed, so that the growing point always contains the youngest cells in the colony.

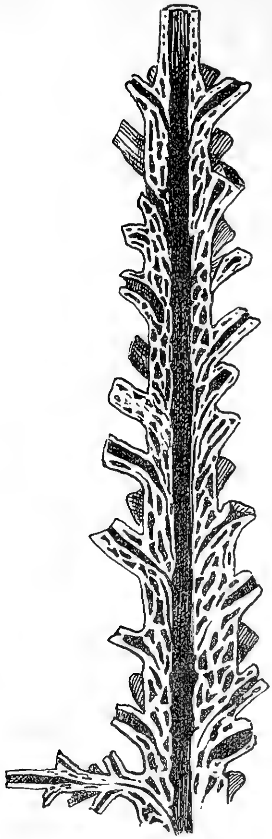
In *Group* 2, however, this state of things is entirely altered, for there one zooid, which is situated at the extremity of the stem, and which I shall call throughout the "dominant apical zooid," constitutes the growing point; and this zooid is the parent of the entire colony.

The zooid that settles down to establish a Madrepore colony has the peculiar innate property of perpetual growth and perpetual youth; and this original zooid grows up and up, budding new zooids from its sides, until destruction overtakes it. As a matter of fact, a Madrepore colony usually starts as a flat growth which spreads from its edges, but this method of growth lasts for only a very short time; and all the characteristics of the "dominant zooid"—which is here the central zooid—are even then well marked.

Besides possessing these peculiar physiological distinctions, the "dominant zooid" is marked off from its fellows by a great anatomical feature, for it is a symmetrical zooid. Of the many thousands of daughter zooids budded off from the "dominant zooid," all are not alike; the great bulk are asymmetrical, and are but little raised from the general surface of the coral, but here and there a prominent and symmetrical zooid is given off. Like the "dominant zooid," these lateral zooids possess the power of perpetual growth, and they are the agents in forming the lateral branches. Under certain conditions only very few of these prominent lateral zooids are produced, and then the resulting vegetative growth consists of long straight stems with but few side-branches.

The typical form of vegetative growth of the Madrepores is therefore a branching system, but many variants of this form are

Text-fig. 153.



Vegetative reproduction in Corals.

Diagrammatic section to illustrate the mode of growth of Madrepores: the "dominant apical zooid" is the oldest member.

developed normally and abnormally. Pseudo plate-like growths are common, and they are formed by the anastomosis of numerous branches in one plane. Again, the importance of the "dominant apical zooid" is variable, and some types branch more after the type fashion of the Montipores, for a whole apical series of zooids may be symmetrical.

Having now reviewed, in some measure, the various methods of the formation of the vegetative growth of colonies, it is necessary to see how far these forms of growth are to be reckoned as specific qualities. Here a great difficulty arises, for an enormous amount of time and careful experiment must be devoted to the proving or disproving of each individual case; and though, after long familiarity with living corals, one may feel certain that two entirely different vegetative forms belong to the same species, yet the conclusive proof may be lacking.

Collecting very extensive series of variations will, in some cases no doubt, link up extremely diverse forms, and the studying of the repair of damaged specimens will serve to make clear others; but experimental breeding, and the rearing of identical species in diverse surroundings, must be the final test in most cases. Now this is a work of extreme difficulty, for an adult colony, when removed from its own environment and placed in a different one, almost invariably dies, and the artificial rearing of corals is very troublesome; my experience of corals in aquaria is that it is very difficult even to keep them alive.

The only method that is open to every resident in places where corals flourish, and the one that I followed in the Cocos-Keeling atoll, is the careful noting of every modification of colonies the life-surroundings of which differ by reason of some influence that can be easily recognised. By this I mean that the corals of deep water and shallow water should be compared; those living in the surf and those living in calm spots should be noted; and the corals living exposed to sediment should be contrasted with those living where no sediment is being deposited.

These are extremes of habitat, and at first the corals of two entirely different environments will seem to be quite distinct, but every compromise of conditions will be found in different spots in an atoll, and with every grade of altered surroundings it will soon be seen that there is a modification of coral-growth; and the more completely this method of observation is carried out, the more will the types of extremely different habitats be found to be linked up by intermediate forms. It will be best to study the influence of the different conditions of life-surroundings on the form of vegetative growth, by taking the different possible modifications of environment in order; but first some general growth tendencies of all corals must be made clear.

As a rule, coral zooids and coral colonies tend to grow upwards, and the general form of vegetative growth depends on this fact.

To this rule there are two noteworthy exceptions in this atoll, and these corals (*Cœnopsammia willeyi* and *C. nigrescens*) generally grow with their zooid mouths turned downwards. Now I think these exceptions to be not without interest, for both these corals live in dark places,—they prefer in fact the under sides of boulders, and they possess no symbiotic algæ in their tissues. They are coloured respectively red and black; and I would put it forward as a speculative idea, that it is the innate tendency of the symbiotic algæ to grow upwards, rather than any innate property of the corals themselves, that causes the general growth tendency of the corals.

It is true that the zooids on the lower surfaces of plate-forms grow downwards: but as a rule I believe those horizontal plates that bear zooids below are but variant forms of growth of other types: for such corals as have no growth-form except that of a flat horizontal plate do not as a rule bear zooids below.

Some further remarks must be made about plate-like growths; but here is a convenient place to refer to a rather strange fact that Darwin called attention to, and this is, that vertical plates grow so that they offer their flat surfaces to the currents. The same thing is true of growths that are branching forms, for then the plane of greatest branching is that at right angles to the line of current. At first sight this seems a strange thing, for plates growing in rough water become so much more exposed to damage; and yet it is doubtless for the exposure of a larger surface of zooids to the food-bringing currents, that the plate spreads in this direction. This phenomenon is especially notable in the Millepores, the broad laminæ, or fan-shaped growths of which are always opposed to the line of the waves, even when the colony happens to dwell in very rough water.

Two general rules may therefore be laid down that apply to all the forms of growth that have been described: the first, that all corals having symbiotic algæ tend to grow upwards; the second, that all tend to offer their greatest surfaces to the line of currents.

We may therefore assume that every coral embryo that settles upon a site of election, and starts the foundation of a colony, has three inherent tendencies: it has its inherited type form of vegetative growth, and its inclinations to grow upwards and to oppose its growth to currents. Now these tendencies are affected by the nature of the water in which the embryo settles down; and for nearly every coral there is a modification of vegetative growth dependent on the environment: thus most corals have a deep-water form, a smooth-water form, a rough-water form, and numerous variations depending upon the amount of sedimentation that is taking place in the water of their habitat. A coral that grows in rough water is obviously exposed to injury; and those people who have stated that the home of election of the corals is the surf-beaten edge of the barrier, have made an error of observation and of fact. The comparatively lifeless zone of a coral-reef is that part of the barrier that is exposed to the maximum force of the surf, with the rising and falling of the tide.

Such corals as do grow in the almost perpetual crash of the surf are of a very easily recognised type; and when contrasted with the forms of the same species that have lived in calmer waters, they appear to have very few points in common. The type of vegetative growth best suited to resist the force of the waves, is of course the rounded or flattened massive boulder; and the *Porites* masses are the type to which all such growths tend to conform (text-figs. 158, 159, pp. 540, 541).

This rounded form of growth is brought about in several different ways: in *Porites*, and other corals, where the equal reproductive value of all zooids tends to the production of a sphere, it is of course the normal habit of growth; and so such corals have their natural home in the rougher water, and undergo their atypical modifications when developed in other sites.

All branching forms, when growing in rough water, are subjected to a change of habit of vegetative growth; and this change is a very interesting one. It will be pointed out when the process of repair is dealt with, that injury affects various forms of corals differently; and all these rough-water forms are in reality the result of perpetual injury.

It would be an obvious disadvantage to a coral to adopt a highly branching form, when living on the surf-beaten portion of the barrier; for the colony would soon be wrecked and broken up by the waves. There is no Montipore in the atoll that lives by election in rough water, but occasionally colonies become exposed to strong currents; and then the perpetual injury to the upper portions causes the growing clusters to be broken up and confused; and the resulting growth is an irregular mass of short stunted branchlets.

Montipores in rough water may also take on a creeping habit of growth, and form encrusting layers on the surface of dead massive colonies; but they are not corals that are at all common in any but the calmest water. Their usual home is the lagoon, and the greatest normal departure from their favourite habitat is in the current-swept shallow inlets to the lagoon; and here an endless series of modifications may be collected, ranging from branching forms to mere amorphous masses and encrusting layers. (Pl. XXVII. fig. 1 *c*.)

The rough-water forms of the Madrepores are highly characteristic, and all depend on the processes that always occur in this group when the "dominant apical zooid" is injured. Instead of a growth that consists of few dominant zooids situated at the extremities of long branches, a rounded mass is formed; and it is composed of little groups of symmetrical zooids surrounded by others that are asymmetrical—each little group representing a branch in an extremely abbreviated form.

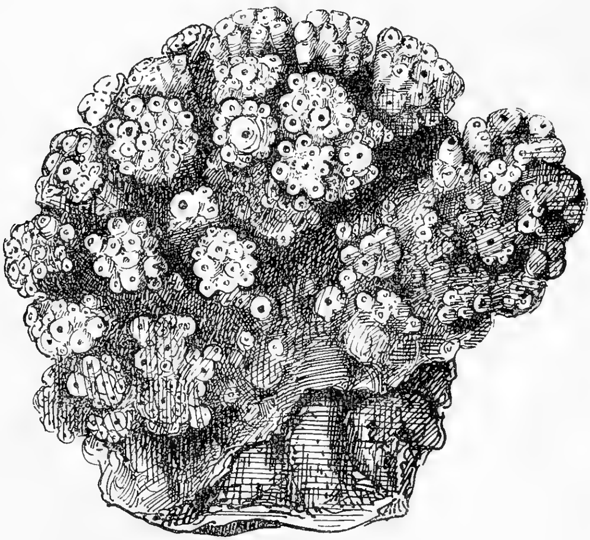
From these extreme rounded masses, with branches that are mere bosses on the general surface, every transition form may be collected, up to the highly developed lagoon types, with branches many feet in length.

Exactly the same results are produced in the Pocillopores, and here the rough-water type is a flattened growth, with irregular divisions into separate lobes; each lobe representing a separate branching system (Plate XXVII. fig. 3 *c*).

Any coral that chances to establish its colony in rough water exhibits therefore one well-marked characteristic: it always tends to form a rounded, or flattened mass; and this for obvious mechanical reasons. It is a direct outcome of the conditions of the environment, and any zooid must conform to it or perish. Repeated injury to the growing cells is the determining cause of this method of growth; and though the fully developed colony is so totally different to the calm-water form, still the process is easily seen in the making by means of artificially inflicted injury.

Besides the alteration of the general appearance of the vegetative growth, the rough-water environment causes other changes in the coral; for it is diagnostic of a rough-water coral that its structure is compact and dense, and its corallites tend to be flush with the general surface of the growth. The question of the raising of the corallites will have to be discussed again when the action of sedimentation is gone into; it must be stated here, that though the levelling of the corallites in rough-water types is doubtless partly mechanical, it is also due to the fact that in rough water sediment does not tend to be deposited.

Text-fig. 154.



Rough-water type of highly branched Madrepore; from an actual specimen of *Madrepora pulchra* taken from the barrier.

In marked contrast to the rough-water types are those forms of a species that happen to have become fixed in an environment where the water is more or less calm; and here, as every grade of environment is to be found, every grade of modification of the colony is represented.

Corals grow in great luxuriance on the wave-stirred outer slopes of the atoll, but this is a site by no means to be confounded with the surf-line of the barrier. They grow also in the numerous pools of the barrier flats, in the inlets to the lagoon, and in the lagoon itself; and each environment has its own peculiar conditions.

In the barrier pools every modification of life surroundings is to be met with, for these pools are of varied depth, they are filled with sand, or are of bare rock; and they have a varying exposure to the wave action of the barrier breakers. Corals grow luxuriantly in most of them, and they afford the best field for experimental work. Since their conditions change with every cycle of the tides, they form the meeting ground of nearly all the commoner species, for they afford in turn most phases of natural environment. Here are found the highly branched Madrepores and Pocillopores, and many Astreas. The colonies are distinguished as a rule by having their corallites raised, for in most pools sand is being deposited. They are also highly branched and of a bushy form, for they are exposed to injury by moving fragments, and so branch formation is stimulated, whilst the great development of individual branches is limited.

These rock-pool forms show naturally the graduating series of types that connects the rough-water forms and the smooth-water forms; and they show also the intermediate stages of the development of coral structures that are intended for the resistance of the action of sediment.

In the smooth-water forms, the predominant feature of the colony is the fragile nature of the growth. Contrasted with the rough-water forms, these colonies are extremely lightly calcified, and their branching systems are distinguished by their delicacy. Their branches are long and slender, their structure is far more porous, and their whole appearance is quite different to that of the colonies of the same species that chance to reside in wave-beaten areas. (Pl. XXVII. figs. 1 *a*, 2 *a*, & 3 *a*.)

The smooth-water forms lead the way to those growths of corals that inhabit the deeper pools of the lagoon. The deep-water forms are the most fragile of all: their growths are more attenuated, and their branches are given off at far less frequent intervals. There is practically no damage inflicted on the growing points—whether they be growing clusters, or "dominant apical zooids"—and so lateral branch formation is never stimulated. Several of the forms of *Montipora* and *Madrepora* that occur in from 8 to 12 fathoms in the lagoon, are mere cylindrical stems, of great length, and with practically no lateral branches whatever. (Pl. XXVII. figs. 1 *b*, 2 *b*, & 3 *b*.)

Besides the attenuated form and the absence of lateral branching, one other feature distinguishes the comparatively deep-water forms from those that inhabit the surface waters,—and this is the general absence of pigment throughout every portion of the colony. Deep-water forms are therefore as a rule pale or entirely colourless.

It will be seen from these instances that the form of the colony varies as the outcome of the influences of the environment; and every embryo that settles in any habitat has to comply with the demands of the physical conditions, and modify its inherited growth tendency,—or perish. Totally different forms are produced in totally different environments, but these forms must not be regarded as "species," for they are mere variations of vegetative growths in response to the necessities of the life surroundings of the colony.

The type of vegetative growth is affected mostly by the physical conditions of the water in which it lives, but the actual structure of the coral depends greatly upon the presence, or absence, of sediment. Some very strange results are produced by waters in which sediment is held suspended, and from which it is being deposited; and sediment will alter the appearance of a coral more strikingly than any other influence. The deposition of sediment is the greatest agent in causing coral death: corals are very easily killed by even comparatively little sediment, and are profoundly altered by it, if they are to successfully resist its influence.

The extent of silt formation at the surface of an atoll in mid-ocean is hard to imagine, and it has certainly not been appreciated by those experimenters who have attempted to estimate the age of an atoll by catching the silt in a net, as it passes into the lagoon. Adown the submarine slopes of the atoll, for a hundred miles east and west, the bottom was found by the cable soundings to be finely triturated coral-sand, and it is only an uncertain and inconstant fraction that passes into the lagoon. Silt is one of the shifting influences of the atoll, and so may visit the coral colonies for only a brief portion of their lives, and then partial death and strange repair-growths result. In the lagoon, and in some portions of the barrier pools, silt is a constant factor, and here shows to the greatest advantage the modifications that it is capable of producing in coral-growths. Speaking generally, silt alters the vegetative growth-form of colonies only in as far as it produces flat-topped rock masses by killing the uppermost zooids, and causes amorphous and irregular growths by partly killing the uppermost growing cells of the growing points. But in the surface structure of the coral, it produces great and wonderful changes. Its effects are best studied by comparing the upper and lower surfaces of partial plates. In these plates, the upper flat surface is alone exposed to the action of the deposition of sediment, and here the corallites tend to be small, and to be raised from the general surface, and the intervening spaces themselves tend to be sculptured and complicated in various ways (Pl. XXVIII. fig. 2). Below, the corallites are larger and are flush with the general surface, and the intervening spaces are flat and plain (Pl. XXVIII. fig. 1).

Now this condition is entirely the result of the attempt of the uppermost zooids to build a silt-resisting structure.

The corallites are smaller, and are raised from the general surface in order to minimise the chance of silt dropping in and choking the zooid. The intervening coral body is variously sculptured and grooved for the carrying off of sediment, that happens to lodge upon the surface of the colony. Wonderful series of modifications are formed in this way; and a single species shows extreme variations in the size of its corallites, and in their raising from the general surface, when specimens collected from different habitats are compared.

Text-fig. 155.

Text-fig. 156.

Text-fig. 155.—Diagram of type of growth of a Madrepore when living in water free of sediment: *M. pulchra.*

Text-fig. 156.—Diagram of growth of *Madrepora pulchra* when living in a habitat exposed to the action of sediment.

The size of the corallite and its projection from the surface are therefore not safe specific features; for corals of identical species, from sediment-carrying water and from absolutely sediment-free water, exhibit great modifications of these characters.

The vegetative habit of a coral, as we have seen, is no true index of its species; and its method of asexual reproduction, the characters of its corallites and surface structure, and also its coloration, are equally variable.

Coloration depends on many, and very little understood, influences. Corals from deeper waters lose their pigment; and corals that are struggling hard in adverse circumstances—corals in fact that are often about to die—become highly pigmented.

Corals identical in every other respect, and living side by side, may be differently coloured; and nothing is more familiar than the purple, brown, yellow, or greenish *Porites* masses that live under exactly the same conditions, as far as can be determined. Even one colony may be differently coloured in different parts. In *Pocillopora* there is a dimorphism of coloration, some growths being pink and some pale brown: the pink is a very beautiful and striking colour, and yet the corals are identical when dead, and the zooid in both cases is the same.

Montipores vary from yellow to olive-green and brown, and yet the zooid is always of the same sulphur-yellow, and the coral is always identical in other respects.

The general coloration of the coral body cannot therefore be regarded as specific, and the coloration of the zooids also shows a strange inconstancy. Although as a rule the zooids of different colonies of identical species—though the colonies may be very different in appearance—are similar, yet in one colony the individual zooids may be very variously coloured.

There is one very striking case, that is not uncommon in the atoll, of an Astrea, where the zooids on the upper surface are a fine fluorescent green, at the sides of the growth brown, and below white. And here it would appear—as also probably in the deeper water forms—that light had some influence on the production of the pigments. Despite this peculiar variation of the colour of the zooids in one colony, it remains a fact that the zooid is the true index of the species. In all the strange growth-forms and abnormal coloration of *Pocillopora* the zooid remains constantly brown; and in *Montipora*, constantly pale sulphur-yellow. In *Stylophora*, whether the coral is the thinly branched and colourless deep form, or the thickly branched and brownish shallow-water form, the zooid is always of the same yellow colour.

In considering the vegetative forms of the corals of an atoll, it must always be remembered that the environment is not a constant one. Although the coral colony is absolutely debarred from changing the site of its growth, still the physical conditions of its surroundings are always altering. The terms rough water and smooth water, deep or shallow, and sedimenting or non-sedimenting, are therefore only comparative; for what to-day is a habitat free from sediment, may in the course of a few weeks become the site of a copious deposition of silt. The rise and fall of the tide across the barrier must of necessity cause great changes in the life surroundings of the corals in its passage; and so a colony, found in a calm pool, may for a part of its life be exposed to violent wave action. This must always be borne in mind, for the results obtained by careful collecting will not be pure. Corals may be found of different forms, growing in close proximity; but far from being evidence that they are different species, and not mere varieties, they demonstrate the fact that the physical conditions of their surroundings are inconstant, and that, for a cycle each form is, in its turn, the most suitable.

The very inconstancy of the environment is one factor in showing the plasticity of the corals, for the partial death and repair caused by changed conditions afford striking evidence of the wonderful powers of varied building possessed by the zooids.

Experiment with constant physical surroundings must be the ultimate test of variability, and in this connection a very interesting case may be quoted. In the lagoon, a large portion of a tree-trunk was floated, and made fast to an anchor and chain; the wood was used to float a ship's moorings, and remained just two years in the water. When it was removed in 1906, several colonies of *Pocillopora* had started growths upon it, and they had taken up different positions around its circumference. The colonies growing above were flattened bosses; those on the sloping sides showed more tendency to branch; and those below its convexity were delicate branched forms. (Pl. XXVIII. fig. 3.)

Now the environments of these colonies were very different, and they were absolutely constant; at all states of the tide, waves broke upon its upper surface, whilst the sides were in gently moving unbroken water, and the bottom was in comparative calm. The growths might be referred to many so-called species, and they represent many types found in the atoll, and yet no one may justly doubt that they are identical, and that their vegetative growth is entirely the outcome of their differing environment. I believe that this natural experiment indicates the lines along which the real understanding of the "species" of the corals is to be arrived at.

So much for a case in which the constantly different environment caused the production of different types, that would be incorrectly considered as different species; it is now best to follow those cases in which altered environment produces variation in the colony, and causes repair growths to assume entirely different forms to that of the original colony.

Although corals as adults do not have the power of independent motion, but must live and die in the spot where they originally settled down, still they have the characteristic that belongs primitively to all protoplasm—they are capable of resenting injury, and of moving their parts in response to stimuli. If, when in the course of a walk on the barrier, a mass of coral be found the zooids of which are actively extended, it is easily seen that a very slight stimulus will cause them all slowly, but very certainly to retract. A light brush of the surface or a gentle touch will cause a slow response, and the zooids withdraw themselves over the definite area affected. Of the solitary corals *Fungia* furnishes a good example of resentment of injury, for if a living specimen be touched, the delicate tissues covering the rays of its skeleton slowly shrink and become pale, and this condition spreads as a slow and curious wave. The sensitive tissue of the creature thins out over the exposed portions and retracts into the spaces between the rays, so that, from being a delicately glandular and prettily coloured mass of soft tissues, it becomes an almost colourless piece of stone.

These movements of parts are the animal's only means of avoiding injury, and though they afford some protection to the more delicate parts of the zooid, a danger that threatens the whole mass of the coral is a danger that the coral cannot shield itself from.

There is yet another factor in the question of the repair and regeneration of corals, and it is the factor that is so intimately bound up with the problem of the limitless liability of the corals as a class to become modified and to vary. When a name is given to this factor, and it is stated that the corals are a plastic group, it is not quite easy to say what that name should rightly connote; but although the words when used in their more common sense are not at all apt, I would say that the corals are an impressionable and responsive class of animals. They are ready to comply with the demands of their environment; they are, within narrow limits, resourceful and capable of remarkable compromises between the contending forces of inherent growth-form and alterations demanded by changed surroundings.

Judged as we judge the higher animals, the corals are a class of unstable individuals: we can say definitely that a young elephant will grow up to be an elephant and no other beast; but we cannot say that an embryo Millepore will grow to be a branching *M. alcicornis* and not a plate-like *M. complanata* or *M. verrucosa*; we cannot foretell that a young colony of *Pocillipora* will certainly be *P. brevicornis* and not *P. nobilis*, for, depending on the conditions of its surroundings, it might chance to be either.

This very plasticity shows itself not only within the limits of a certain species, but in the life of every actinozooid, for each member of a colony, or each solitary coral, shows in its life, its growth, and its repair, all those endless conformations to the demands of its environment that tend to produce change throughout the whole world of living things. An actinozoon, then, as an individual, possesses a birthright that gives it a maximum power of repair of damage, or regeneration of lost parts; and in the colonial forms, which are of special importance in the economy of the class, this power is greatly intensified.

In the group of solitary corals there is no very great interest attached to the processes of repair. The individual animal is at times damaged by injury, and the damage is repaired by the laying down of new calcified material, causing an irregularity in the symmetry of the animal. As a common feature of repair in any living thing, it may be noticed that the new material laid down tends to be excessive; and few large Fungiæ are to be found in which some injury has not caused the development of a quantity of irregular calcification, where the delicate tissues of the animal have been split over the sharp edge of one of the rays. Excessive injury leads to local death, and local death may affect a very large area of a solitary coral without being necessarily fatal to the whole animal. The individual has but little power of repairing a large portion of its surface when once the area is definitely dead—very often for the reason that parasitic algæ and sponges attack the dead area.

It is not till the colonial forms are reached that the power of repair possessed by the corals is properly seen. In a colony composed of myriads of individuals each actively living, each capable of growth and repair, the very best conditions for repair are at hand, and this is further aided in many cases by the peculiar mode of growth of the colony. There are some inherent characteristics of the lowly animals amongst which the corals rank zoologically that are very wonderful, and that are opposed both to the order of things that prevails in the higher classes, and also to the popular conception of the life-history of the reef-building corals.

I think it is fair to say that the average belief with regard to the building of corals and coral-reefs is that the zooids live and grow, flourish and die, and that their dead bodies form mausoleums on which their progeny found their colony, and thus build islands. Now, in contradiction to this, is the biological fact that the actinozooid is a living thing that knows no time of youthful vigour, no waxing to a period of adult life, no waning to senility—it knows no age—it practically knows no natural death. There is no building on the dead bodies of ancestors, no perpetual dying and new birth; and a colony of Madrepores will contradict this popular fallacy at one glance, for, whatever the age of the growth, the parent anthozooid flourishes till death or accident overtakes the whole. It is a wonderful thing—and one that is not, I think, generally considered—that the age of some of these individuals in every colony must be excessive, even reckoned as we reckon the age of higher animals. When we consider the very slow rate of growth of some corals, and the great size of some of the colonies to be seen every day on an atoll reef, and when we rightly understand their mode of growth, and recognise that the pioneer organism of the colony is still flourishing there, we cannot help being struck by the excessive antiquity of that organism as a living entity. That an apical zooid of a branching Madrepore colony should be ten years old seems wonderful, but these individuals are mere juveniles when some of the component zooids of massive growths are considered.

Throughout the prolonged life of these lowly animals the process of repair is a possibility, and a strange paradox is presented in some forms, for the most aged member of the colony shows the greatest activity in all the processes of renewal and repair.

The coral colony increases in size by the budding-off of new zooids and the deposition of new calcium carbonate in their tissues, and just as this is the ordinary mode of growth, so it is the ordinary mode of repair. The type of repair naturally tends to follow the type of growth of the injured colony; and the various genera of corals might be taken in order and the details of the repair of injury noted for each genus. But it is more likely that some idea of the bionomics of the group will be gathered from the general study of the phenomena as they affect the life-history of the coral, than from a survey of the manner in which the, by no means satisfactory, classification of the types affects the phenomena.

I. *Among the colonial forms there is a sympathy of individuals, so that each member of a colony takes its share in resenting the injury to a part, and by an increased activity tends to compensate for its loss, or to assist in its repair.*

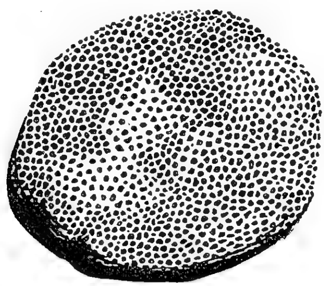
In connection with this sharing of each individual in the fortunes of its fellows and of the entire colony, it may be remembered that it was stated that the whole population of a colony may suffer shock from an injury inflicted upon only a small portion of it, and that even the zooids remote from the seat of injury will frequently not re-expand for forty-eight hours after the injury was inflicted, and this is so even when the injury is very trivial.

Now after the receipt of an injury, the effect produced by this communal sympathy varies in different forms of coral, for in a colony, as we have seen, all the members may be of equal importance, or some may be of greater value than others as producers and directors of growth.

(A.) In a coral such as the massive forms of *Porites*, where the growth-tendency is to form spherical masses, every living entity in the whole vast crowd of active members bears an equal share in building and in reproducing. It is this equality of all the zooids in the community that produces the characteristic spherical form of the young growth, and the equality of the zooids plus the receipt of injury produce the typical flat-topped circular rocks into which the old colony generally shapes itself. When a mass of *Porites* has attained some size as a sphere, the zooids that lie below are necessarily stamped out of existence by the weight of the accumulated mass. It is not often, of course, that the environment is so ideal that anything like a perfect sphere is ever formed, but still, in sheltered pools, many forms of corals may be obtained resting free on the bottom, with every portion of their surfaces living. The original nucleus has been covered equally upon all sides, and the weight of the colony is not sufficient to cause the death of those zooids that happen to live on the under side. But as this mass increases in size and weight, death of the lowest zooids must inevitably occur, and the rest of the surface-area carrying on the compensating building, will cause the growth to become dome-shaped. Theoretically, the dome shape would be the type of form of all the massive species that follow this method of growth and division, but practically the dome shape is far less common than the flat-topped rock, and this is for the reason that injury to the uppermost zooids is usual in the life-history of a colony.

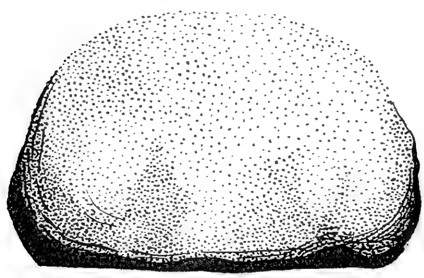
When the dome has become of some size, its upper surface becomes large enough and flat enough to form a resting place for sediment, and the uppermost zooids decline in activity, the compensating growth carries the sides further out, and the colony tends, by the increase of the rest of the surface, to become still more flattened at the top. Injury caused by loosened fragments sweeping over the surface of the rocks, and the further deposition of sediment, finally cause the wholesale death of the zooids of the flattened tops, and now their fellows round the margins form, by their active growth, swelling lips about the plateau, and make cushion-like bosses that tend to enclose a central flat depression in which sand accumulates, and on which other and differently growing species of coral may lodge and flourish.

Text-fig. 157.



Young *Porites* mass grown equally round a central nucleus.

Text-fig. 158.

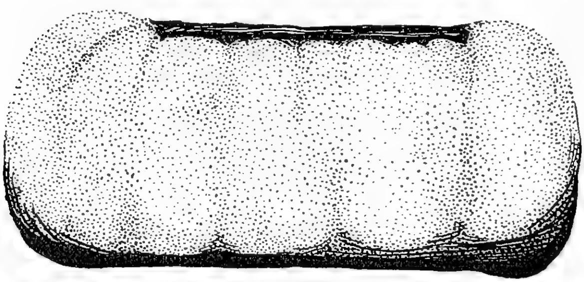


Older *Porites* colony in which the lower zooids are killed by pressure.

This process may be described as the normal accident of the life-history of those species in which the equality of the zooids of every portion of the colony is a life-condition; and it furnishes a good example of the rule of Nature's utter disregard for the life of the individual, for all those zooids on the upper surface must certainly be killed by sedimentation or by injury, when they have succeeded in making their colony of sufficient size.

The same process that leads to the normal shaping of massive coral colonies may be seen on a small scale at myriad points upon the surface of the growth. The actual amount of living tissue in a large growing boulder is very small, for the depth to which the living animal tissues of the zooid extend beneath the surface is very slight, and yet the calcified portion that extends from the living margin to the centre of the rock must in no way be regarded as the accumulated and dead remains of past generations; for it is in reality the skeletons of those zooids whose mouths are now showing at the surface. It follows therefore, that since the skeleton devoid of animal tissues is incapable of carrying out any repairs, a superficial injury is most likely to lead to the death of a definite area of zooids on the surface—this area representing the base of a cone whose apex is at the centre of the colony (text-fig. 145, p. 521). The zooids over this area, if definitely destroyed

Text-fig. 159.



Adult colony of *Porites* in which the upper zooids are killed by sediment.

in the extent of all their living animal tissues, are not regenerated, but a sympathetic growth takes place round the edges of the area, and new material is thrown out, new zooids are budded off, and the dead area is finally invaded and covered from the active zooids of the edge. It is due to this process of repair that many of the boring molluscs become enclosed in corals, for when the surface has been attacked and killed, the margins by their sympathetic activity tend to bridge over the injured area and enclose the mollusc, which finally comes to rest in a cavity beneath the surface of the coral.

The rounded cysts found in the substance of most specimens of the massive corals, and which contain an encysted mollusc, are therefore not to be regarded as entirely the work of the mollusc, but are due to sympathetic activity of zooids in the coral colony.

Besides boring molluscs, several species of worms attack corals and hollow out tunnels this way and that through their living substance, and here too, the sympathetic reaction of the zooids is shown. The tunnels destroy whole groups of zooids and replace the solid skeleton of the coral by a series of tubes, and the strength of the whole colony is greatly diminished; around these tubes the uninjured zooids divide and grow with increased activity, new calcium carbonate is thrown out, and an attempt is made to compensate for the destruction of tissue caused by the worm. Some curious results are brought about in this way, and specimens in which worm-boring has led to fantastic growth are always to be found, for few corals escape their inroads. A tunnel running superficially, or in the thickness of a plate-like growth, leads to an increased activity of surface-growth of the zooids, and the tunnel stands out boldly from the surface, covered and strengthened by an ever advancing layer of coral. In this way a tunnel may actually bridge a space from one plate to another, and its mouth be carried out clear of the general surface of the coral, for where the tunnel goes the surface-layer of coral ever keeps pace.

(B.) The question of the processes of repair becomes further complicated in those corals, such as the Madrepores, in which all the members of the colony are not of equal importance. We have seen, in considering the mode of growth of such corals, that the very first individual in a colony may continue to flourish and lead the growth of the entire community as long as that community lasts. The original zooid that, as an embryo, settled on the basis that formed the site of growth may be the "directive" zooid of the entire colony, and the apical zooid may represent the oldest living animal matter in the community. But besides the "directive apical zooid," others arise at intervals by budding from the sides, that are possessed of more inherent vitality than their fellows, and from their first birth they tend to grow out as new directive zooids and lead to lateral branch formation—and besides, these more virile lateral zooids are the hosts of individuals that in the normal condition of the growth reach no greater dignity than a uniform projection of their corallites.

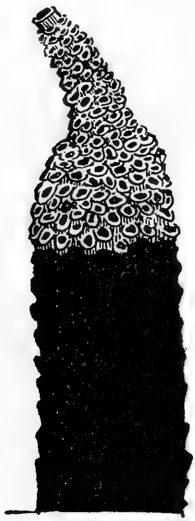
Now when injury or destruction affects a portion of the colony, it reacts on individuals whose functionating values in the economy of the colony are not equal, and so we should expect that the result of injury or destruction would vary according to the different parts of the colony on which the maximum of damage falls. And this is the case. The actual results of repair of various injuries inflicted in experiment, or by Nature, will show more clearly the relative values and functional activities of different portions of such a colony, than will any amount of theorising or speculation.

1. If the injury be so inflicted that the branch of a Madrepore colony is broken transversely, and the injury is limited to a mere fracture of the cross section, then the repair takes place by the activity of the "apical directive zooid."

There is, as we have seen, no portion of a Madrepore colony that normally dies, and the obliteration of animal tissues in the proximal portion of any zooid is a late change; and therefore, if the fracture takes place not very far from the end of a branch, the inherent vitality of the terminal zooid predominates, and it starts the repair by continuing to grow out in the direction of its original axis of growth, and by budding new zooids from its sides.

In a measured specimen that was fractured cleanly across one of the main branches without other injury to the colony, the apical zooid had, at the end of a hundred days, grown out 1 centimetre and had budded from its sides forty lateral daughter zooids; and the general surface of the fractured end showed seventy newly-formed coralla of old and new zooids. During the same

Text-fig. 160.



Type of repair of Madrepores when the "dominant apical zooid" is not destroyed. Process at the end of 100 days.

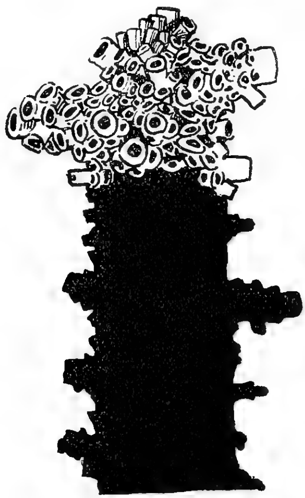
interval of time a branch of about the same diameter on the same colony, that had received no injury, had advanced by 1·5 centimetres and had added about a hundred and twenty new lateral zooids; so that, judged as growth in these corals must be judged, the rate of repair is a rapid one. In this case the dominant zooid is apical, and its superior vitality enables it to regenerate and to continue the growth along the lines of original branching; but if the vitality of the "apical directive zooid" is definitely destroyed, a very different state of affairs is brought about.

2. If the "apical directive zooid" is destroyed, and especially if the damage is extensive and affects a large area of a branch, the predominant functions of the apical zooid are taken over by the

more vigorous lateral zooids, so that there is a tendency towards branch-formation below the site of injury.

This state of things, when put into terms of the life functions of the colony, means that potentially almost any lateral bud possesses the inherent vitality of the apical zooid, but it is only in times of stress to the colony that this potential power becomes actual. A stem of a Madrepore colony may shoot up straight for the distance of a foot, and show nothing more worthy of the name of a branch than the normal projections of dominant zooids scattered irregularly over its surface; but if sufficient damage be done to it to destroy the apical zooid as well as a fair portion of its entire length, then the remaining part will at once start

Text-fig. 161.



Type of repair of Madrepores when the "dominant apical zooid" is entirely destroyed. Process at the end of 100 days.

budding with vigour. The best examples of this mode of repair are seen in those cases in which a colony is attacked by filamentous algæ. The thin green threads of this parasite enmesh the branches, and penetrating into their substance, lead rapidly and certainly to the death of the part attacked. Artificially produced injuries also provide good examples of this mode of repair. The first stage is noticed when, in contrast to the dead terminal portion, the living part swells out, its dominant zooids become more conspicuous, and their projections increase until they arrive at a stage at which they themselves give off lateral buds. The number of these enlarged lateral zooids may be very great, but not all of them ever attain the dignity of actual branch formation.

By the end of a hundred days after the receipt of injury the uninjured central end of a branch is roughened all over its surface by the projections of lateral zooids, and those of them that will form new branches have already begun to develop secondary buds from their sides. This process cannot be spoken of with absolute accuracy as an actual repair, for the part injured surely dies, and its substance is never regenerated; but it is a process by which the sympathetic activity of the remaining zooids in the community is called into action, and the potential power of branch formation inherently lodged in the dominant lateral zooids is turned into a real power. The value of this process in the life-saving of a species is obvious, for the growth tendency of a Madrepore colony is to steadily develop upwards, and the limit of this upward growth is either at the water-level, or at a level at which protection from rough water and moving fragments afforded by the shelter of surrounding rocks, is lost. Now a colony that grows up beyond its upward limit of safety will sooner or later have its terminal ramifications killed by exposure, or broken by waves or moving fragments; and the injury that destroys the power of the apical zooid causes the lateral buds to branch out at angles to the parent stem, and spread fresh zooid-bearing surfaces far and wide in the area of safety. It is this process that is the great determining cause of the general growth tendency of Madrepore colonies, and the one that causes the deep-water and shallow-water forms of the same species to vary in their vegetative forms of growth.

3. If in a colony the injury is such that the apical zooid is neither injured nor destroyed, but the damage is limited to the surfaces of a branch, then the repair takes place as in colonies in which every zooid is of equal value.

This repair is well seen after experimentally inflicted injuries, and the process of carrying out the regeneration of the destroyed area is very like that previously described as occurring in those corals that grow like the massive forms of *Porites*.

The first step is the active marginal growth and the formation of an excessive quantity of new material, which, in the form experimented on (*Madrepora pulchra*), is at first of a light-blue colour, and is semi-transparent. In this new material the mouths of corallites soon appear, and the edges become covered by a host of uniform zooids, which soon spread over the entire area destroyed by the injury, provided that the area is not too large, and that no alga settles on it in the meanwhile. It may be stated here that in experimental injury, many experiments fail for the reason that the destroyed or injured area commonly becomes a focus for the invasion of boring parasites, worms, molluscs, sponges, and algæ, and the pure results of injury and repair become complicated.

Where no such complication existed, areas of 5 by 5 millimetres, 20 by 8 mm., 20 by 10 mm., and 25 by 12 mm., were completely covered by new material with a multitude of new zooids in the course of 100 days, whilst larger areas were commonly attacked by sponges or algæ before repair was completed. Very much the same process is seen to occur when constricting metal bands are placed round branches. The zooids, where the bands exert their pressure, are destroyed, and the general growth of the branch and the sympathetic activity of the zooids at the margin of the injury soon tend to cause the band to sink into the substance of the coral, and to become completely embedded beneath the surface.

It was previously stated that the type of repair naturally tends to follow the type of growth of the injured colony; and this is generally true. If a coral has a particular mode of growth, and if it be in such an environment that its mode of growth is the one most suitable, then an injury is repaired or a part regenerated on the same type of growth as that of the colony. But the particular form in which a colony may be growing may not be the form best suited for successfully flourishing in that particular environment; and then, following an injury, a remarkable state of things is brought about, which may be stated as follows:—

II. *A coral may repair an injury by a new growth of a different type to that of the colony, and in such cases the repair growth is of a form better suited to the environment than is the form of the parent colony.*

It must be borne in mind that the physical conditions of the atoll are not absolutely constant; seasonal changes in sets and strength of currents are perpetually causing alterations at all points of the island ring, and a habitat may alter greatly in its physical conditions in the course of a few months. When a coral embryo settles down upon a basis, and starts the founding of a colony, the type of growth that will result will be what is best fitted to the environment as the embryo finds it. But suppose that, after the founding and growth of a colony, the physical conditions of the environment change, rough water is admitted, silt settles down, or the water becomes shallow and calm: then the growth of the colony may not be the ideal one for flourishing under these new conditions.

In many places where the conditions are prone to vary, the habitat of the corals may alter in its physical nature in more or less regular cycles. Where, as at the eastern extremity of Pulu Tikus, a spit runs out, building sheltered pools and protecting the shore for a considerable distance, and then later on, in the periodical cycle of currents and eddies, is carried away; many corals must be subjected to a great variation of environment. In such circumstances no doubt many colonies die, for, as we have seen, a sudden change of habitat cannot be resisted when a form is well adapted for one definite kind of environment, and in any case the colonies are liable to injury and partial death in their changed surroundings.

When such injury falls on a coral not ideally situated, the repairing growth exhibits a strange independence, and, forsaking the growth-form of the colony, builds its repair in the form best suited to the new conditions of the environment.

This is a strange zoological fact, that the inherent growth-form, once stamped upon a well-established colony, continues to be the type of growth, though it be but ill adapted to its habitat; and yet, when the continuity is once broken and a new start is made, the newly-budded zooids can throw off the stereotyped method, and build anew to the altered conditions.

It is facts such as these that give some clue to the understanding of the vast range of variation occurring within the limits of a species, and make the establishing of a species a matter of extreme doubt, until every possible variation that different surroundings will stamp upon the type has been examined. We have seen, in following the life-history of corals, that the colony shows great adaptability, being able to mould its growth in response to the demands of its environment, and in this repair process it possesses a further power, for it can entirely alter the structure of an established colony.

Numerous examples of this strange process may be seen. A branching Montipore, growing in a gap in the island ring, is found to have every colony dead or damaged in a greater or less extent of its whole growth. The damage is probably due to the fact that currents have altered the physical conditions of the habitat since the founding of the colonies, and that a greater rush of water has brought more sand and moving particles in contact with them, for the apical branches of all the colonies within a definite area will be found broken. The repair of this damage invariably takes the form of an amorphous encrusting growth covering the débris of the dying colony, the regenerated portion keeping pace with the destruction, and thus keeping the colony living — but living as an entirely different type of its species. (Pl. XXIX. fig. 1.)

Madrepore colonies show the same phenomena, and very strange repair-forms of *Pocillopora* growing in rough water as encrusting growths may be found.

When, after repair, a Madrepore colony assumes an encrusting form, as it frequently does, the inherent tendency of its growth is still evident, for rising at intervals from its flat surface are numerous dominant zooids, which, were the opportunity afforded them, would form upward-growing branches.

It is by no means uncommon, in this process of repair, not only for the vegetative growth of the colony to be altered, but for the actual type of the corallum to be changed. When a Montipore repairs its own ill-situated and dying colony by an encrusting growth, the whole minute structure of the coral is changed. Instead of the smooth surface over which the fairly wide mouths of the corallites are dotted, is a coral with an outward appearance notable chiefly for its extreme roughness, due to the development of numerous papillæ at the bases of which open the minute coralites (Pl. XXIX. fig. 1). The characters of the original growth and of the repair growth are so entirely different, that they would certainly be regarded as two distinct species. Other examples of this entire change are not uncommon, and some very strange abnormalities may be found, which show that in repair, as in adversity and in alteration of environment, there is practically no limit to the developing of the different main types of growth by any coral. It is common in repair of injury as it is in cases of adversity, that the bounding walls of the newly-budded zooids are never completed, and repair by a pseudo-meandrine form of fission is often met with in many and widely-separated species of coral (Pl. XXIX. fig. 2). It is common, too, to find that the repair-zooids have raised coralla, when those of the parent colony are flat, and in these cases it is probably silt that has caused the original damage.

The study of the repair in corals is therefore one not devoid of zoological interest, for it shows clearly that a type must never be considered as a species, in the way in which we regard species among the higher animals, until it has been seen in all its variations, and until all the possible modifications that repair produces have been studied.

That a type like the encrusting Montipore should be in reality the same species as the branching form, would be considered as highly improbable, but when it is seen that the one type repairs its damage by the development of a new growth of the other type, there is no alternative but to regard them as identical species.

That the numerous types of *Millepora* and of *Pocillopora* should be but variants of a single species would seem at first sight to be very unlikely, for there is little enough likeness between the extreme forms, and yet their processes of repair show them capable of building to any of their diverse types, regardless of the nature of the parent growth.

If the processes that have been described, and the conclusions that have been drawn from them, be accepted, they can serve only to make clearer the great fact that morphology—the animal's type—is the outcome of necessity; and here the demands of necessity bring about change, not in the life-history of a species only, but in the life of the individual.

Since these repair-forms are the outcome of the partial death of the colony, and since the growth-forms of many colonies are determined by the normal, or abnormal, death of portions of their surface, it will be well to briefly review the processes by which death overtakes a colony.

The subject of repair leads naturally to the consideration of the death of the organism, for when the destructive processes outweigh the resources of repair, then death must inevitably ensue.

There is one fact in the life-history of corals that the study of their processes of repair clearly brings out, and it is this, that all the methods of regeneration are more for the life saving of the colony than of the individual. It is a rule with Nature that the life of the individual is a thing of little moment: Nature has little care for individuals, though she strives always to maintain the life of the species. In a vast community of individuals, as is a coral colony, each separate member is but a part of the whole body, and the preservation of the colony is a thing of more import than the saving of a few individuals. A branching Madrepore grows naturally upwards into the danger zone, and the terminal branches are inevitably destroyed, with the sacrifice of a myriad of zooids; but the result is a stimulus to lateral branching within the area of safety, and the colony continues to flourish.

In every massive growth starting to develop on all sides of a nucleus, those zooids that are budded below can never hope to live, and those on the upper surface will in all probability die. In all the processes of repair that have been described, it is not the individual that is mended, for an individual once badly damaged is not repaired; but the loss is made good by the growth of new zooids that take on the functions of those lost. Repair in colonial forms does not save the individual from death, but it preserves the life of the colony. Now loss by death in a colony is not always repaired.

We have seen that the flat tops of the massive growths of *Porites* remain devoid of living zooids, and in several types of growth, death of a portion of the colony is more or less usual; among the branching *Porites* it is normal to find the lower portions of the growth dead, and no attempt made at their repair.

When it is said that the partial death of a colony is more or less usual in some types of growth, it is not in any way meant that the progress of coral formation is a building of the living zooids upon the dead bodies of past generations, for the partial death is due, as a rule, to very definite outside causes.

In this atoll the greatest cause of coral death has been a quite unusual one, but it has been a most instructive one, for it brings out some very interesting facts in the life-history of corals. In 1876 all the living coral of the south-east portion of the lagoon was entirely destroyed, by the pouring out of foul water from a volcanic vent at the southern side of the atoll. The picture presented by these denuded areas was described by Dr. H. O. Forbes in 1879, and by Dr. Guppy in 1888; and in 1906 there is still the same tract of dead coral on which the efforts at re-colonisation have been practically unavailing.

This remarkable failure of the corals to repopulate a large portion of the lagoon, is probably due to the fact that during the period immediately following the disaster, various algæ such as agar-agar and several other species, being of a faster and more hardy growth, stepped in and took possession of the area before the slow growing corals could obtain a proper footing. The growth of algæ is in itself hostile to the life of corals, and, apart from that, the algæ beds in the lagoon are the greatest factors in catching silt, and piling up the shifting sand-banks the presence of which is so fatal to coral-growth. These two factors, aided perhaps by subsequent minor volcanic poisonings, have so completely paralysed all coral activity, that to the south of Pulu Selima there has been in many places no trace of new growth; and the abnormal death that occurred thirty years ago has to this day remained unrepaired.

Although such events as this are quite exceptional in the life-history of corals, or of coral islands, still the after history of the disaster shows on a large scale the influences of those factors that in the normal life of corals tend to bring about their death. It is the silt and seaweed that have prevented corals from flourishing on their old site, and the silt and seaweed are to-day in the atoll the two great causes of coral death.

The influence of matter suspended in the water is one of the most far-reaching factors in the life-history of corals: it is to resist its effects that many of the vegetative forms are evolved; it is on account of the silt that many acres of the lagoon are devoid of coral-growth; and it is probably on account of the presence of silt that wave action is so necessary to coral life, and that the unstirred depths below about 20 fathoms are comparatively bare of coral.

Silt, sand, or suspended matter may cause the actual death of corals in two ways:—(a) *It may fall upon them and choke their zooids from above.* (b) *It may overtake them from below.*

Of these two actions examples are always to be seen in (*a*) the partial death of the tops of massive *Porites* colonies (text-fig. 159, p. 541, & Pl. XXIX. fig. 2), and in (*b*) the stems and lower branches of branching Madrepores which are normally lifeless. In these cases the death is only partial, for the reason that the colony is one capable of resisting as a whole the amount of suspended matter normally present in the waters of its habitat; but if the amount be suddenly increased, then the colony may be unable to resist it, and general death ensues. Evidences of this mode of death are seen in the gaps in the island ring where an alteration of current brings more silt than is usual to the growing colonies, and very interesting results may be produced experimentally. On December 13th, 1905, several healthy living colonies of rough-water forms of *Madrepora* and *Pocillopora* were removed, without exposure or injury, from their habitat of rough barrier water, and without any delay were placed in marked sites in a sheltered sandy pool of the barrier-flats. In the same pool, which is almost completely cut off from the sea at low tides, and then contains about 2–3 feet of water, and which is about 100 yards long by 20 wide, numerous corals live and flourish, calm-water forms of *Madrepora* and *Pocillopora*, capable of resisting silt, being the most abundant. The conditions of life in these barrier pools are peculiar; the pools are filled with sand, for the fragments which are triturated by their journey to and fro over the barrier are deposited in them, they contain the minute green filaments of the boring algæ, and at mid-day low tides they become heated by the sun to 93° Fahr. and more. Their coral fauna is practically always the same, *Madrepora* flourishes in its most highly branching forms, *Pocillopora* always has a good foothold, and the other species are in plenty, but hardly in a state of luxuriance. Bêche-de-mer in hundreds live in these pools, and crustacea, polychætes, mollusca, eels, and the myriad brilliant fish make up the conspicuous fauna. Of the many rough-water colonies that were transplanted experimentally into this environment, not one remained alive at the end of 50 days, and most were dead within a month. The first sign by which a colony shows that its environment is not suitable is by becoming highly pigmented; both rough-water forms are, when flourishing, very pale corals, being usually of a light buff colour, but within a fortnight the transplanted colonies had become of a dark yellow-brown, and in *Madrepora* there was a more than usual tendency to lateral branch formation. In 20 days most colonies had some portion dead, and the dead parts became rapidly the site of growing algæ; in 30 days nearly all the numerous transplanted colonies were dead or dying, and by 50 days no portion of any colony remained alive. It was silt that had determined the death of them all; the stunted, flattened types of *Madrepora* and *Pocillopora* are both corals of a rough-water habitat, they are used to clear water in which there is little or no suspended matter, and not a single colony was able to withstand the slow but certain sedimentation of the barrier pool; when the silt had once fairly determined their death, the fine boring algæ completed the ruin. If any colony of branching coral be removed entire from the lagoon, it will be found that the lower portion is invariably dead; but this death is in most cases not a natural one resulting from the senility of the zooids, but merely an index of the amount of silting up of the lagoon that has taken place since the establishing of the colony. Sand is ever being washed into the lagoon through the numerous gaps in the island ring, and most decidedly the tendency all over the lagoon is a gradual filling up, by the deposition of finely triturated fragments: the floor of the lagoon is fairly steadily rising, and those colonies of corals growing in its bed are for ever being encroached upon by the gradual rising of the sand level. The deposited sand most certainly kills the zooids with which it comes in contact, and the result is that the lower portion of every lagoon colony is killed.

Silt then, in this atoll, is the most potent factor in causing coral death, and next in importance to the silt comes the seaweed.

There is a green alga that, at some seasons of the year more than at others, comes to the barrier pools in great quantities: it is a growth of fine green threads and its effect on coral-growth is really wonderful. A pool in which numerous flourishing colonies live, quite on a sudden may show the advent of this alga, and every portion of every colony which may receive a chance injury at once becomes the site of the growth of these fine threads. I believe that it is always at the site of injury that the attack of the alga starts, but its growth soon invades, and invariably kills, the living healthy portions of the colony. A colony once fairly invaded by this parasite rapidly dies, and yet it never succeeds in obliterating coral-growth, for as suddenly as it came to the barrier pools, it goes. Spring tides and hot weather seem to promote its growth, or perhaps lower the resistance of the coral colonies, for when the rock-pools are left long to swelter in the sun, with but little depth of water in them, then the alga seems to be most active. It is a great factor in causing the death of the atoll corals, and ranks in Cocos far in advance of the boring sponges, worms, or molluscs as a destructive agent.

The more obvious boring creatures do not cause damage to the colony other than to weaken its structure, and lead to its more ready destruction by the action of the waves or moving fragments; and beyond this, they cannot be rightly considered as effective enemies of coral-growth. There seems to be indeed an almost symbiotic relation between certain boring animals and the corals that they have chosen as their hosts, for coral-growth extends and strengthens their tubes by sympathetic growth, and the cavities of the molluscs in many cases expand the living area of the surface of corals by causing irritation and repair. It is an extraordinary thing to see the extent to which a colony of *Millepora complanata* may be riddled with the wide smooth-walled tubes, and yet not be appreciably weakened, and the result of observation on such colonies is that the borings are very little harmful to the colony.

Another cause of coral death to which much importance has been attached is the exposure caused by the receding tide, for it has been said that corals cannot survive even a temporary exposure to the sun and air.

Since Darwin first claimed this as an axiom of coral bionomics, a great deal has been taken for granted with regard to the effects of exposure, and yet every fresh investigator has attached less and less importance to it. Now as a matter of fact there is no species of coral in this atoll that is not able to withstand an exposure of many hours to the mid-day sun, with from 6 inches to a foot of its apical growth above the water: there is no barrier species that does not normally suffer this at mid-day spring tides. There are many isolated rocks that are ordinarily exposed for two feet at low tide, on which living corals flourish luxuriantly. When season and winds combine to cause tides abnormally low, it is possible to go from island to island along the barrier-flats, and for the greater part of the journey to walk in but a few inches of water; and if such a walk be taken during a low tide at hot mid-day, then the smell of the exposed coral is almost overpowering and may be noticed far out in the lagoon. Coral has an odour that is peculiarly offensive when the growth is exposed to the air, and this strange odour is no sign of death, for a stinking coral when replaced in water or when re-covered by the rising tide, flourishes again. At such a low tide the barrier-flats present a picture of bushes and boulders of living coral all freely exposed to the sun, all dry, all smelling very offensively, and yet the returning tide finds them all living as actively as when it left them. A coral may be taken from the bottom of the lagoon, may spend the best part of a hot day, high and dry, in the bottom of a boat, and yet, when it is replaced in the water, all its zooids will expand, and it will resume all its vigour. Exposure to the sun and air between tide limits plays but little part as a causative factor in the question of coral death. Of course no coral could grow beyond the normal high-tide level, but the remarkably level appearance of the barrier-flats is not the result of the action of sun and air on the coral colonies, so much as of the levelling effects of the waves, and the moving fragments that they wash to and fro. It is the grinding action of the surface waters at their level of maximum activity that determines the limiting level of upward coral-growth, far more than the death of the apices from the effects of sun and air. The waves that sweep over the flats, and carry shorewards the fragments that they have broken from the seaward margin of the barrier, are for ever keeping the coral colonies within the limit of upward growth; but their action is not altogether detrimental to the corals, for though, where island beaches are formed, many fragments of living coral are cast ashore only to perish, still many more, where no such dry land exists, are safely lodged in a new resting place. Broken fragments are swept across the flats, they lodge in pools, they become stranded under the lee of boulders, or are washed into the lagoon; and each of these fragments, if not too badly damaged, will form the nucleus of a new colony in a suitable habitat. If a large colony of a Madrepore be broken up in the rock-pool where it flourishes, the great majority of its fragments will continue to grow and branch out into new colonies; and if some of these fragments are swept onwards by the waves, they will form pioneers for the species when lodged in a suitable environment.

Freshening of the water from the excessive tropical rains has been said to cause wholesale death among the lagoon corals; and in high islands were rivers flow into the sea, the fresh water is well known to be a great cause of the absence of coral-growth. Before Darwin's visit to the atoll it is said that an abnormal rainfall killed many corals, and again in 1866 the fresh water is said by the Governor to have stood for a height of several inches on the surface of the lagoon, so heavy and continuous was the rain. Again, in May 1896, the rains were abnormal, and the freshening of the water destroyed the lagoon algæ and fish; and this in such quantities that when Mr. Arthur Keyser visited the islands in July, the dead fish were still being cleared from the lagoon. There is no doubt that the rain would have to be long continued, for all those corals that live in rock-pools are immune to the influence of the fresh water accumulated during a heavy downpour at low tide. When the tide is low and the rainfall is heavy, the rock-pools undergo a remarkable degree of freshening, and so too does the lagoon if the weather is calm and the rainfall is a sudden one.

In the lagoon the surface specific gravity may fall to 1021, but I have never found it lower, and the perpetual churning of the waves prevents any marked evidences of freshening being observable near shore. Outside, in the ocean itself, there is such complete mixing of the waters at the surf-beaten barrier edge, that it is not likely that the influence of the rain could be recognised.

On Feb. 13th, 1906, when ·28 of an inch of rain fell in ten minutes, the sp. gr. of the surface of the lagoon dropped from 1027 to 1021, and the temperature was 77°·5.

On Feb. 24th, after ·5 of an inch of rain had fallen in half an hour, the sp. gr. was 1023, and the temperature was 82°·7.

On Jan. 4th, after 7·4 inches had fallen in the passed 12 hours, the sp. gr. was 1021, with a temperature of 78°.

The surface of the fish-pond, which is a pit about 15 feet square, will show a reading as low as 1015 three days after a downfall of 5 inches in twelve hours, although its waters rise and fall with the tides, and the outside ocean shows no change after the downpour.

It is therefore mainly wave-action that obliterates the effects of tropical showers in freshening the salt water, and the coincidence of great rainfall and dead calm must be very complete, and very lasting, before anything approaching a general destruction of corals could result.

Many animals have been ranked amongst the enemies of corals, and Darwin classed some fish and the myriad Holothuridæ as causes of coral death. In this atoll Dr. H. O. Forbes has described the "Scarus feeding in the surf on the living coral," and has asserted that the Kakatua and other lagoon fish actually eat the living polyps. The observation has been several times doubted, and, so far as this atoll is concerned, it is certainly an error. There are no fish and no Holothurids in Cocos Keeling lagoon, or on the barrier, that eat coral when it is living, though many different classes of animals contain great quantities of dead coral in their alimentary canals. The importance of the coral-haunting fish and the Holothurids as factors in atoll formation is great, but it is not as destroyers of living coral that they fulfil their rôle, for the coral that they took in at their mouths was already dead.

From the study of the life of the colony in different surroundings, and from the repair of injury, and death, in unsuitable habitats, I think it will be seen that the number of the true species of corals is by no means so great as is at present supposed.

There is no doubt that a great number of our museum-made species are mere vegetative varieties, produced in response to the demands of the environment; and I do not think it is possible to determine from a fragment of growth—often with no sufficient data—if it be a new species, or even a new genus, or if it be a mere vegetative variety of some already well-known species.

There can be but little utility in the naming and describing, with great minuteness, of all these variations; for of this work there can be no end, and persistent collecting, from even such a small area as the Cocos-Keeling atoll, would yield such a variety of fragments as would occupy a lifetime to describe.

In very many cases one single colony could be found to provide several types of growth, that if presented as fragments, would be deemed to merit individual description as species.

In such cases some factor in the physical condition of the surroundings will show, when the colony is *in situ*, the cause of these different modes of growth; but when the colony is transported to a museum, it presents a very striking puzzle.

One side of a colony may be shaded from light, sheltered from currents, or protected from silt; whilst the other side may be exposed to all these influences: and then it is but natural that the two sides should vary, and—knowing the wonderful plasticity of the zooids—the great differences are not astonishing.

Besides the occurrence of colonies that exhibit two or three well-marked types of growth, there are those that can only be called "undecided" forms, and these present growths that are intermediate in character between two well-marked, and very diverse, types. Such "undecided" forms are very common, but it is the natural instinct of the collector to pick out well-marked and well-grown forms as his specimens.

I have not included *Millepora* in these remarks, but the genus is well worthy of notice; and although the three types—*Millepora alcicornis*, *M. complanata*, and *M. verrucosa*—occur in great abundance in the atoll, and present very different appearances in their extreme forms, I do not doubt that there is but one species of Millepore, with three variations of vegetative growth, and an infinity of gradations connecting them. I do not doubt either that all the forms of *Pocillopora* that are found in the atoll are in reality one species; and I strongly suspect that there is only one species of *Montipora* in Cocos, although its varieties are legion. The species of *Madrepora* in the islands are in reality very few, many diverse forms are certainly identical species, but experimental breeding must finally settle how few these species are.

It is the same throughout the whole series of the Cocos-Keeling corals; there is a very limited number of species; and I would account for the origin of the many varieties, and the present confusion of their nomenclature, by the alteration of environment caused by atoll formation. I imagine that the origin of the atoll from an original submerged bank will be unquestioned; and on this submerged bank I would imagine that the corals represented few species and few varieties.

The life-conditions all over the bank were fairly uniform, and there lived upon it *Pocillopora*, *Montipora*, and the other corals, exhibiting probably one form of growth only, and one that is represented by an intermediate type to-day.

With the origin of the heaped up débris that forms the island ring, and with the formation of the barrier above the level of the tides, a gradual change occurred, and in the place of one uniform environment, an infinity of diverse habitats was produced.

The rough water of the barrier, the smooth water of the lagoon, the silting water of the inlets, and the clear water of the ocean, were marked off from one another; and the embryos of the originally similar corals had to grow dissimilar to adapt their vegetative types to the new formed habitats.

In this way the present infinity of types was brought about, and wherever the environment is changing to-day new types are developing to conform with its demands.

EXPLANATION OF THE PLATES.

Plate XXVII.

The influence of environment on vegetative form of Corals.

Fig. 1. Three types of *Montipora*, growing respectively in (*a*) fairly smooth water, (*b*) deep water, (*c*) rough water.

Fig. 2. Three types of *Madrepora* from (*a*) fairly smooth water, (*b*) deep water, (*c*) rough water.

Fig. 3. Three types of *Pocillopora* from (*a*) fairly smooth water, (*b*) deep water, (*c*) rough water.

In each case the figures are of extreme varieties, and the extremes are linked together by every grade of intermediate variety.

Plate XXVIII.

The influence of environment on vegetative form of Corals.

Fig. 1. The under surface of a plate-like growth, to show the characters of the corallites.

Fig. 2. The upper surface of the same plate, to show the great difference of appearance of the two surfaces.

Fig. 3. Colonies of *Pocillopora* taken from a floating log. They are photographed in the positions that they occupied on the surface of the log, and they illustrate well the change of type of vegetative growth in response to environment.

Plate XXIX.

Processes of repair and death in Corals.

Fig. 1. Specimen showing a branching *Montipora* which, when in adverse circumstances, repairs its dead areas by an encrusting growth. The new growth has very different characteristics of corallite to those of the original growth.

Fig. 2. Specimen showing death of zooids caused by deposition of sediment; and also partial assumption of meandrine form of division caused by adversity.

J. Green, Chromo.

LACERTA TAURICA, VAR. IONICA.

2. On *Lacerta ionica* Lehrs, a Variety of *Lacerta taurica* Pallas. By G. A. Boulenger, F.R.S., V.P.Z.S.

[Received May 23, 1907.]

(Plate XXX.* and Text-figures 162–165.)

In a paper dealing with the inter-relations of the South European Lizards of the genus *Lacerta*, published a few years ago †, Herr Philip Lehrs has proposed the name *Lacerta ionica* for a form inhabiting the Ionian Islands, which had been referred by previous authors to *L. taurica*, *L. muralis*, or *L. peloponnesiaca*, and which he regarded as a species allied to but quite distinct from *L. taurica*.

I have at various times received examples of this Ionian Lizard through Dr. F. Werner and Herr Lorenz Müller, and I have lately procured a number of living specimens from Corfu, two of which are represented on the coloured plate appended to this paper. I have availed myself of this material to institute a careful comparison of *L. ionica* with *L. taurica*, and to put to the test the characters adduced by Herr Lehrs for their separation, with the result that I am unable to agree with this author's conclusions.

I cannot find characters to justify a specific separation. The dorsal scales are, as a rule, a little smaller (hence more numerous) in the Ionian Lizard than in the typical *L. taurica* from the Crimea,—a character which has not even been alluded to by Hr. Lehrs; but, as will be seen by the numbers of scales given in the following table, this is not constant, and there is really no correlation between the scaling and the coloration. The difference in coloration is not of a very fundamental kind, and will be found to be bridged over when a large series of specimens is available for comparison. As to the structural characters adduced to justify a specific separation, they do not stand the test of a critical examination.

Taking them in the order in which they appear in Hr. Lehrs' description, I note:—

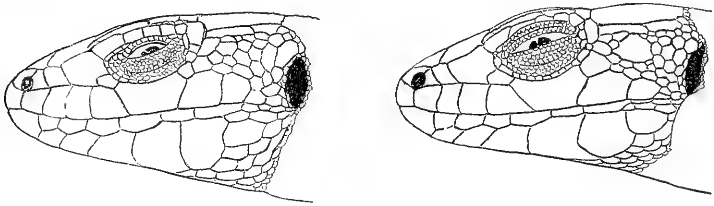
1. *L. ionica* is stated to be larger than *L. taurica*. There is, however, very little difference between the two. My largest male *L. taurica* (from Roumania) measures 68 millim. from snout to vent, and Kiritezcu ‡ mentions another measuring 71; my largest male *L. ionica* measures 80. Considering the variation in size to which all Lizards are subject, this character has no importance whatever.

2. The shape of the head is believed to be different, being more pointed, with a less "sheep-like" profile, in *L. ionica*. The

* For explanation of the Plate, see p. 566.
† Zool. Anz. 1902, p. 225.
‡ Bul. Soc. Sci. Bucarest, x. 1901, p. 314.

figures here given, delineated from photographs, of male specimens of the two forms (Roumania and Cephalonia), chosen as being practically identical in form, will dispose of this supposed difference. The most pointed head in the whole series at my disposal is to be found in a female from Rutshuk, Bulgaria, typical in coloration.

Text-fig. 162.

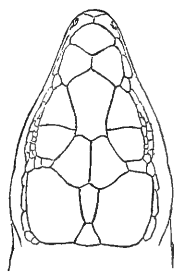


a *b*

Lacerta taurica.

Side views of heads of males: *a*. Roumania; *b*. Cephalonia.

Text-fig. 163.



Lacerta taurica.

Upper view of head of female, Rutshuk, Bulgaria.

3. The tail of the male *L. ionica*, it is stated, is nearly twice or even a little over twice the length of head and body, whilst that of *L. taurica* does not exceed 1·7 times that length. Here are measurements (in millimetres) of head and body and tail in a few males of both forms with intact tails:—

L. ionica.				*L. taurica.*			
1.	2.	3.	4.	5.	6.	7.	8.
67	67	63	63	71	62	62	55
127	128	122	110	127	118	117	100

1, 2. Corfu; 3, 4. Cephalonia; 5. Roumania (after Kiritezcu); 6. Roumania; 7, 8. Hungary.

4. Neck thick, not so constricted in *L. ionica*. I cannot appreciate this difference.

5. Frontal shield about as long as frontoparietals in *L. ionica*, considerably longer in *L. taurica*. I cannot understand how such a statement can have been made, and a few measurements will suffice to refute it :—

	L. ionica.					*L. taurica.*				
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Fr.	5	4	4	4	4	5	$4\frac{1}{2}$	4	4	4
Frp.......	4	4	$3\frac{1}{2}$	3	3	$4\frac{1}{2}$	4	3	4	$3\frac{1}{2}$

1–3. Roumania ; 4–5. Hungary ; 6–7. Corfu ;
8–10. Cephalonia.

6. Occipital shield as large as or a little larger than the interparietal in *L. ionica*, smaller in *L. taurica*. The reverse is sometimes the case, although, as a rule, the occipital is a little longer, as compared to the interparietal, in the former than in the latter.

7. Dorsal scales feebly keeled in *L. ionica*, strongly in *L. taurica*. The degree of carination is variable in both forms, but I have before me a female from Roumania (*L. taurica*) in which the dorsal scales are truly granular, and almost smooth.

8. The caudal scales are more pointed in *L. taurica*. These scales are more or less pointed in both forms ; there is no constant difference between the two.

9. Collar more strongly serrated in *L. taurica*. Again I find no constant difference. Lehrs is wrong in saying that the collar is never really serrated in these lizards, " Ein *wirklich gezähneltes* Halsband (wie etwa *L. viridis*) hat eigentlich keine der erwähnten Formen [*L. taurica*, *L. ionica*, *L. littoralis*]." I give further on (text-fig. 164 *a*, p. 563) a figure of a *L. taurica* from Sebastopol, which shows that the collar may be as strongly serrated as in *L. viridis*.

And that is all, so far as structural characters are concerned.

As to the coloration, I confess the appearance of the beautiful Corfu Lizard, when alive, is strikingly different from that of a typical *L. taurica*, as may be seen by the figures on Plate XXX. But the only real difference consists in a preponderance of the green colour, which extends to or beyond the light dorso-lateral lines which are usually at least indicated in the females and young in *L. taurica* the green colour is usually restricted to a median band on the back (text-fig. 165 *a*, p. 565), but this band may be much broadened on the anterior part of the back, as shown by some Roumanian specimens (text-fig. 165 *c*, p. 565), which thus form a link between the two extremes. The extent and disposition of the black spots may be the same in the two forms. Some of the Ionian specimens have a vertebral series of black spots, or may lack spots and streaks altogether, and thus differ from the typical *L. taurica* ; but such differences are not outside the range of variation which we know in many other species of Lizards, even within the limits of a race, e. g. *L. muralis*, vars. *littoralis* and *serpa*.

I append a table showing the amount of variation in the lepidosis in the adult specimens at my disposal.

		1.	2.	3.	4.	5.	6.	7.	8.
Crimea	♀	63	54	6	30	9	23	20–19	27
Bakal, Crimea	♀	54	49	6	32	9	22	17	24
Sebastopol	♀	59	51	6	30	9	23	17	24
"	♀	47	48	6	31	9	20	18–17	25
Roumania	♂	68	52	6	29	11	24	16–15	24
Dobrudja, Roumania	♂	67	50	6	26	9	21	18	27
" "	♂	62	48	6	27	8	20	19–18	26
" "	♀	60	50	6	31	8	20	18	26
" "	♀	55	55	6	31	11	25	17–18	24
Greci, Macin Distr., Roumania	♂	48	48	8	26	11	20	19–18	24
Rutshuk, Bulgaria	♀	54	51	6	31	10	25	19–17	25
" "	♀	54	52	6	28	11	21	18	26
Bazias, Hungary	♂	59	55	6	28	10	23	17	26
" "	♀	59	51	8	29	10	22	17–16	25
Rakos, nr. Budapest	♂	62	50	6	27	10	21	15	22
" "	♀	61	49	6	30	9	22	15–16	23
Szabadka, Hungary	♂	55	50	6	26	8	22	17–18	23
" "	♀	55	51	6	30	9	21	16	22
Constantinople	♂	56	53	8	27	10	24	20–19	25
L. Stymphalos, Morea	♂	64	50	6	26	9	23	21–20	26
" "	♂	58	55	6	26	9	21	18–17	25
" "	♀	63	42	6	31	9	19	17–18	24
Nision, G. of Messenia, Morea	♂	80	59	6	28	11	25	20–21	29
" " "	♂	75	54	6	27	9	22	19–20	27
" " "	♂	70	60	6	28	11	20	20	26
" " "	♀	68	57	6	31	9	22	20	25
" " "	♀	66	61	6	31	9	23	20–21	25
Cephalonia	♂	70	60	6	27	9	28	23–25	25
"	♂	63	58	6	29	10	21	24–25	24
"	♂	63	59	6	27	9	24	20	26
"	♀	67	59	6	31	11	25	23–22	28
"	♀	66	55	6	32	10	22	22–23	29
"	♀	56	60	6	29	9	24	21–22	27
Corfu	♂	70	56	6	28	9	23	21–22	27
"	♂	67	59	8	28	10	22	21–19	28
"	♂	67	57	6	28	9	21	19–18	25
"	♂	67	53	6	26	11	21	21	25
"	♂	67	55	6	26	9	23	20–19	24
"	♂	65	57	6	28	9	23	21	25
"	♂	65	53	6	26	10	21	18	25
"	♂	63	52	6	25	12	22	18–16	24
"	♂	63	57	6	27	11	23	21	26
"	♂	63	52	6	26	9	22	19	25
"	♂	60	60	6	25	10	22	19–20	26
"	♀	57	56	6	25	10	21	15–16	25
"	♀	62	53	6	29	10	20	17–18	26
"	♀	52	53	6	28	10	22	17–15	25

1. Length (in millim.) from snout to vent. **2.** Number of scales across middle of body. **3.** Longitudinal series of ventral plates. **4.** Transverse series of ventral plates. **5.** Number of plates in collar. **6.** Number of scales and granules between symphysis of chin-shields and median collar-plate. **7.** Number of femoral pores (on right and left sides, if differing). **8.** Number of lamellar scales under fourth toe.

Description of *Lacerta taurica* and its variations.

Form and Proportions.

Intermediate between *L. agilis* and *L. muralis*, var. *campestris*. Head rather small (4 to $4\frac{1}{4}$ times in length to vent in males, $4\frac{1}{4}$ to $4\frac{2}{3}$ times in females), as deep as broad or not much broader than deep, once and a half to once and two thirds as long as broad, exceptionally once and three fourths *; occipital region convex; snout obtusely pointed, with straight or slightly convex upper profile, as long as the distance between the eye and the ear-opening; depth of the head, in the tympanic region, equal to or a little greater than the distance between the anterior corner of the eye and the anterior border of the tympanum. Neck as broad as the head, or a little narrower or a little broader. Body moderately depressed. Hind limb, in the males, reaching the axilla, the shoulder, or the collar; in the females reaching the wrist or the elbow of the adpressed fore limb; foot as long as the head or a little longer (not more than once and one fourth). Tail once and a half to slightly over twice the length of head and body.

Palatal teeth.

A few small teeth are nearly always present on the pterygoid bones †.

Scaling.

Rostral shield entering the nostril, often largely ‡. Nasals forming a short suture behind the rostral §; frontonasal much broader than long ‖; frontal as long as or shorter than its distance from the end of the snout; parietals once and one fourth to once and one third as long as broad, in contact with the upper postocular; occipital very variable in shape, usually shorter than the interparietal, sometimes fused with, or separated from it by a small shield ¶. An incomplete series of granules between the supraciliaries and the supraoculars, the first supraciliary being constantly in contact with the second supraocular, the granules sometimes minute or reduced to 2 to 5 **. Postnasal single ††. Four upper labials anterior to the subocular ‡‡. Scutellation of

* In a male from Nision, Greece.

† These teeth are very rarely present in the vars. *campestris* and *serpa* of *L. muralis*, and appear to be constantly absent in the typical form of that species.

‡ I have observed only two exceptions (♀ from Szabadka and ♀ from Corfu), in which the nostril is narrowly separated from the rostral.

§ In a ♀ from Nision, Greece, the frontonasal forms a suture with the rostral; in a ♂ from Cephalonia the nasal is in contact with the anterior loreal, above the postnasal (see text-fig. 162 *b*, p. 558).

‖ Broken up into four shields, forming a cross, in a ♀ from Bazias.

¶ As long as the interparietal in a few specimens from Greece and the Ionian Islands.

** In specimens from Crimea, Bulgaria, Hungary, Cephalonia and Corfu, as in some specimens of *L. peloponnesiaca*, in which species the granules are usually entirely absent.

†† Two superposed postnasals in a ♂ from Nision.

‡‡ Five on one side in a ♀ from Szabadka and in another from Rutshuk; three on each side in a ♂ from Cephalonia.

Measurements (in millimetres).

	♂									♀					
	1.	**2.**	**3.**	**4.**	**5.**	**6.**	**7.**	**8.**	**9.**	**10.**	**11.**	**12.**	**13.**	**14.**	**15.**
From snout to vent	80	75	70	68	67	64	63	62	56	68	66	63	62	61	60
„ „ fore limb	29	29	27	26	27	24	23	24	22	24	22	22	23	22	20
Length of head	20	19	18	16	17	16	16	16	14	15	14	14	14	14	14
Width of head	13	11	11	10	11	10	10	10	$9\frac{1}{2}$	9	$8\frac{1}{2}$	9	9	8	9
Depth of head	12	11	10	9	10	9	9	9	9	8	7	8	$7\frac{1}{2}$	8	8
Fore limb	26	23	23	20	22	20	21	21	20	20	18	19	19	17	17
Hind limb	43	41	39	33	35	34	35	32	32	31	31	30	30	27	27
Foot	22	22	21	18	20	18	19	17	17	16	17	16	16	14	15
Tail (* reproduced)	150	100*	145	120	105*	78*	123	117	98	105	113	105	75*	90	65*

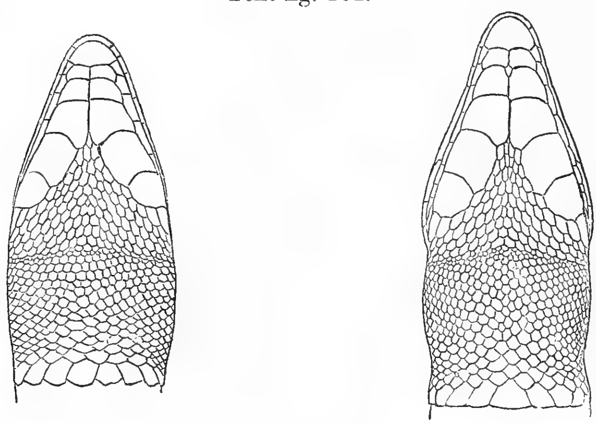
1, 2, 10. Nision, Morea.
3, 5, 13. Corfu.
4. Roumania.

6, 12. L. Stymphalos, Morea.
7, 11. Cephalonia.
8, 14. Rakos, Hungary.

9. Constantinople.
15. Dobrudja, Roumania.

the temple very variable, the two extremes (text-fig. 162, p. 558) approaching *L. agilis* and *L. muralis* var. *campestris* respectively, masseteric and tympanic shields usually distinct, the former sometimes very large and in contact with the supratemporals, of which there are usually 2 or 3 *. 19 to 28 scales and granules in a straight line between the symphysis of the chin-shields and the median collar-plate; gular fold always well marked. Collar formed of 8 to 12 plates (usually 9 to 11), the edge more or less distinctly serrated; the extremes of serration are shown on the following figures of two female specimens, one from Sebastopol, the other from Cephalonia.

Text-fig. 164.



a *b*

Lacerta taurica.

Lower views of heads of females: *a*. Sebastopol; *b*. Cephalonia.

Scales on body juxtaposed, oval or oval-hexagonal, very small and more or less diagonally keeled on the back, larger and smooth or very feebly keeled towards the ventrals. Exceptionally the scales on the back may be almost perfectly round granules, with a feeble straight keel † or even almost without a trace of a keel ‡. In a male from Rakos, Hungary, which has very strongly keeled dorsal scales, and in a male from Corfu, the scales on the flanks, right down to the ventral plates, show a feeble but yet distinct keel. The number of scales across the body varies from 42 to 61 §. On the flanks, 3 or alternately 2 and 3 series of scales correspond to one ventral plate. 36 to 50 transverse series of dorsal scales correspond to the length of the head.

* Only one in a ♂ from Szabadka.

† ♀ from Crimea and Szabadka, Hungary. ‡ ♀ from Rutshuk, Bulgaria.

§ 42 is exceptional and occurs only in one ♀ from L. Stymphalos, Morea, two males from the same locality having 50 and 55 respectively.

Ventral plates in 6 (exceptionally 8) longitudinal and 25 to 32 transverse series.

Anal plate moderately large or rather small, with two or three semicircles of small plates or scales, one or two of the median plates of the inner semicircle sometimes considerably enlarged.

Scales on upper surface of leg usually smaller than the dorsals, more or less distinctly keeled. 22 to 29 lamellar scales under the fourth toe.

Femoral pores 15 to 25 on each side, 15 to 20 (usually 16 to 19) in the typical form *, 15 to 25 (usually 18 to 21) in the Ionian specimens.

Caudal scales more or less obtusely pointed behind, the upper strongly keeled, the lower smooth or feebly keeled; the whorls subequal in length; the fourth or fifth whorl behind the postanal granules contains 30 to 37 scales.

Coloration.

In the typical form (text-fig. 165 *a*) the brown colour predominates on the upper parts, with the exception of a broad vertebral stripe which is of a more or less bright green; a light streak may extend from the outer border of the parietal shield to the base of the tail and another from below the eye to the groin; the sides of the body are more or less spotted or marbled with black, except on the green vertebral band, and the black spots may extend across or over the light dorso-lateral streaks, which often entirely disappear, especially in males. In some specimens † (text-fig. 165 *b*) the black markings predominate over the ground-colour and enclose small whitish spots, whilst in others they are large and few, forming a regular series on each side of the back ‡, or small and numerous, or confluent into a wavy line bordering inwards the light dorso-lateral streak §. The lower parts are white, yellow, or deep orange, without spots, or with small black spots on the sides; pale blue spots are present on the outer ventral plates and just above them. The dark and light spots on the tail combine to form a more or less distinct striation.

In all the specimens from Greece and the Ionian Islands examined by me, the green colour predominates (at least in the spring) and the green and brown striation of the back is never shown by them. However, as noticed above, specimens from Roumania (text-fig. 165 *c*) are intermediate between the two types of coloration. In these Greek and Ionian specimens a vertebral series of black spots is occasionally present. As observed by Lehrs, a form without any spots or streaks, in either sex, occurs on the Ionian Islands.

Living specimens from Corfu are of a beautiful grass-green

* 15 to 22 according to Kessler.

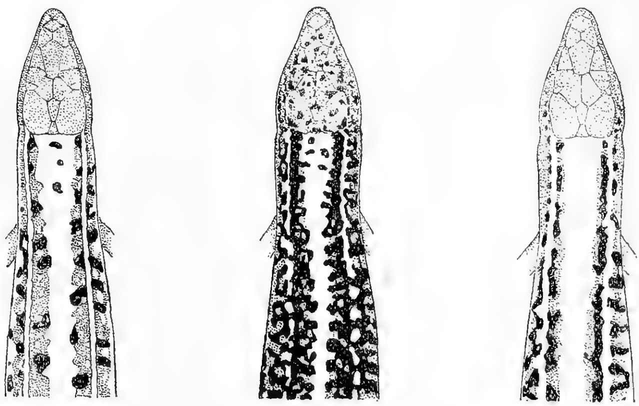
† Males from Hungary.

‡ Females from Crimea, Roumania, and Bulgaria.

§ Male from Roumania.

above (head, neck, body, fore limbs, base of tail), shading to greenish yellow on the lips and down the sides of the neck. The black spots are usually small. A pale brown or golden colour forms spots or a band on each side of the posterior part of the body and on the base of the tail. Hind limbs and tail brownish grey, with light spots. The ocellar marking above the shoulder, alluded to by Lehrs, is absent, or imperfect, the centre green, not blue. A male is uniform green, with the sides of the sacral region and of the base of the tail, the hind limbs, and the tail reddish brown; in a female, the brown extends further forward on the sides of the body. The belly is greenish or yellowish white, or pale yellow, with pale blue spots on the outer ventral plates. The iris varies from pale golden to copper-red *.

Text-fig. 165.



a b c

Lacerta taurica.

Head and anterior part of body:
a. ♀. Roumania; *b.* ♂. Hungary; *c.* ♂. Roumania.

The female specimen here figured represents the "forma *olivacea*" of Lehrs (p. 236). I have always objected to the bestowal of latin names on such individual variations. In this case, the "forma *olivacea*" is not even constant in the individual, as since the lizard has been placed in spirit it has produced a dark lateral band edged with whitish, thus resembling very closely some of the typical specimens from Cephalonia mentioned by Lehrs as devoid of dark spots.

In conclusion, I very much doubt whether *L. taurica* and *L. ionica* can be sufficiently well defined to be separated as distinct

* I have noticed the same variation in the typical form of *Lacerta muralis*.

varieties (or subspecies). At any rate the difference between them does not seem to me greater than that which separates the var. *bocagii* from the typical form of *L. muralis*. According to the evidence furnished by the specimens at my disposal, the typical form occurs in the Crimea, in Roumania, Hungary, Bulgaria, and Turkey in Europe, the var. *ionica* in Morea and the Ionian Islands.

As pointed out by Lehrs, his *L. ionica* constitutes a very interesting link between the true *L. taurica* and those forms of *L. muralis* (vars. *campestris* and *littoralis*) which, contrary to the opinion of L. von Méhely, I regard as the most primitive in structure as well as in markings *.

EXPLANATION OF PLATE XXX.

Lacerta taurica var. *ionica*.

Male (lower figure) and female (upper figure) from Corfu.

3. On Neotropical *Lycænidæ*, with Descriptions of New Species. By Hamilton H. Druce, F.Z.S., F.E.S.

[Received May 22, 1907.]

(Plates XXXI.–XXXVI.†)

The genus "*Thecla*" as used in the present paper contains most of the species placed in it by Westwood and by Hewitson, and includes nearly all the Neotropical Lycænidæ. It is used in the same sense as by Messrs. Godman & Salvin in the 'Biologia Centrali-Americana,' and the species are referred to as nearly as possible as in that work.

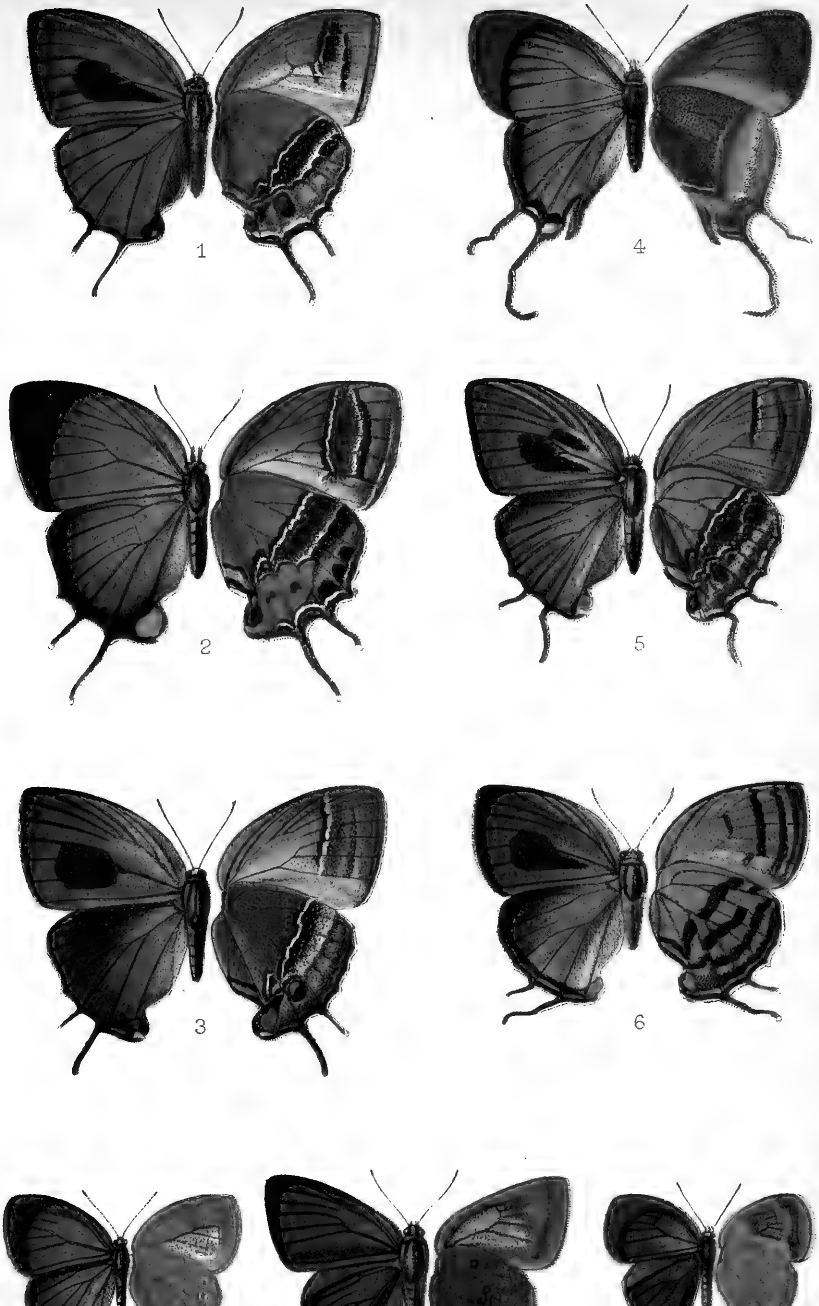
Many genera have been proposed by Hübner, by Scudder, and lately by Mr. W. J. Kaye for various forms—some on account of the "scent-glands" or "brands" which are found in the male sex of many species, some apparently on the shape of the wings, some on slight differences in the position of the nervules. But the fact remains that the venation of the wings is very much the same in all the various species.

Some are tailless; others have one, two, or three tails to the hind wing; and, as pointed out by Messrs. Godman & Salvin in 'Biologia Centrali-Americana,' in some species the brands on the fore wing appear to influence the direction of the veins, in others they do not. The terminal joints of the palpi in some species are longer than in others, and the robust or slim appearance of some is very apparent.

From a very careful examination of a considerable material, Messrs. Godman & Salvin in Biol. Centr.-Amer. did not consider generic division advisable (except in one case, i. e. *Theclopsis*, in which the tarsal joints of the front legs of the male have not

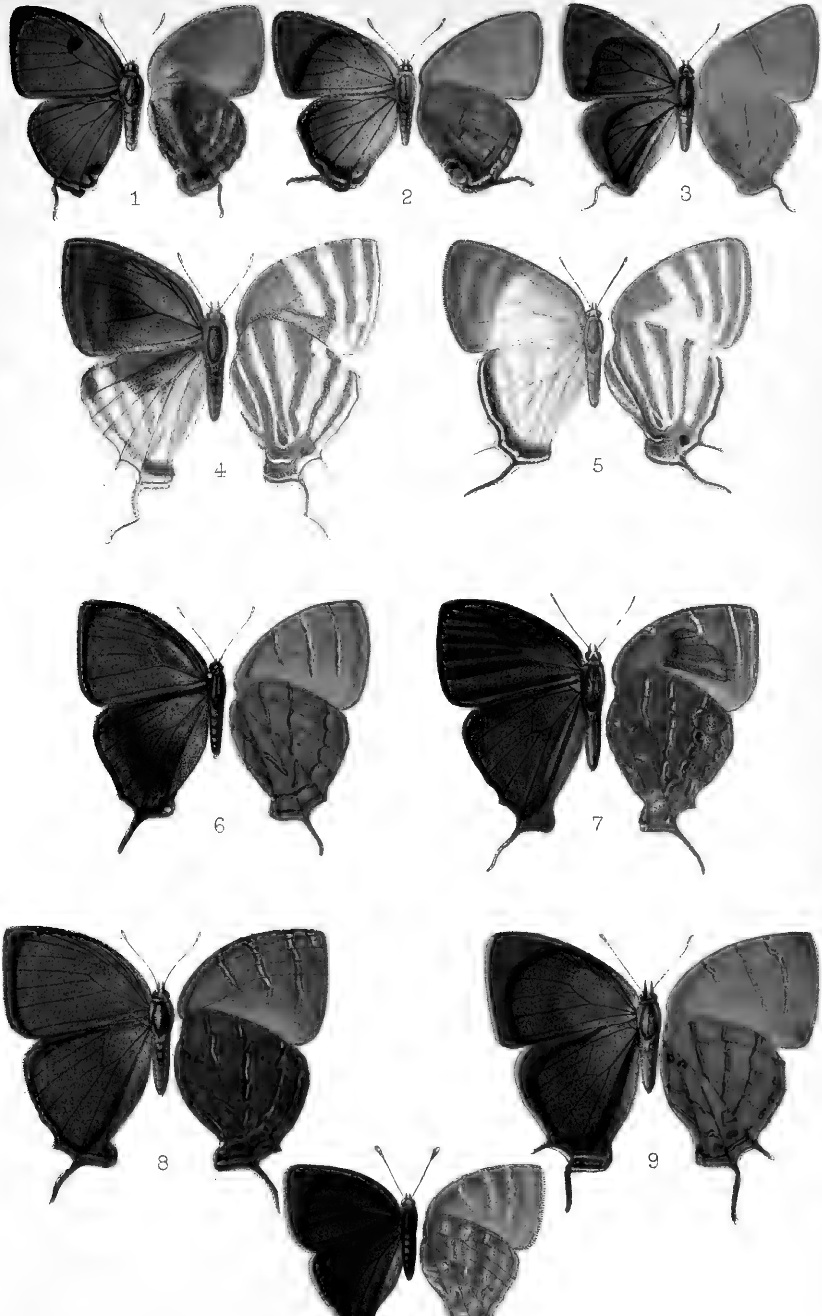
* See my remarks in Ann. & Mag. N. H. ser. 7, vol. xx. p. 39.

† For explanation of the Plates, see pp. 631–632.



E.C. Knight ad nat. del.   West, Newman chromo.

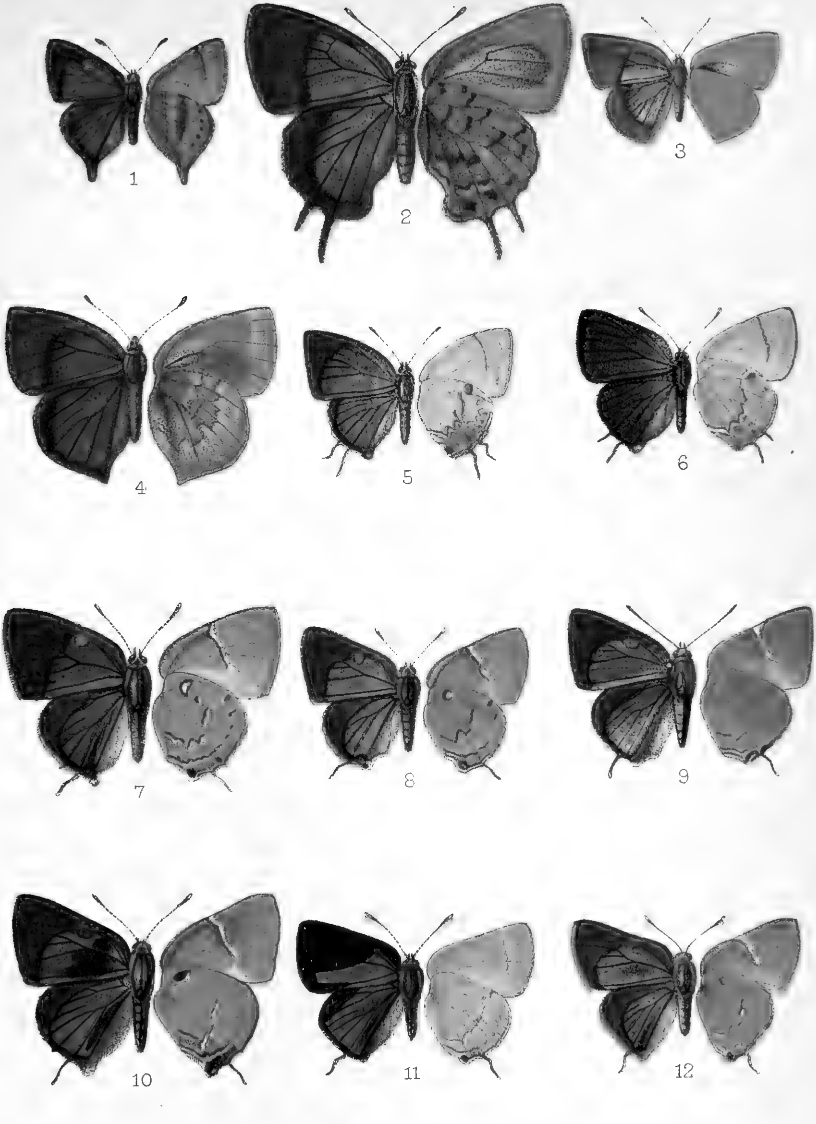
NEOTROPICAL LYCÆNIDÆ.



E. C. Knight ad nat. del.

West, Newman chromo

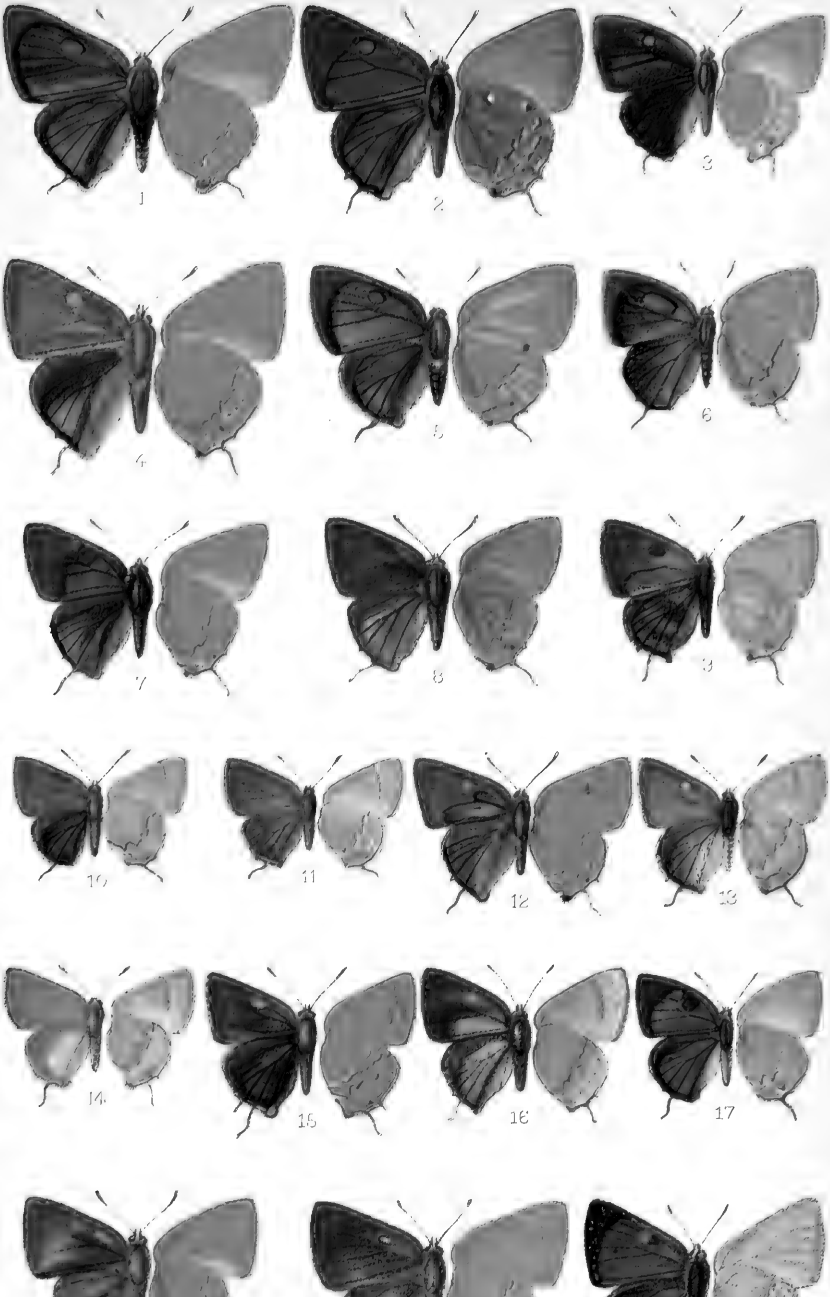
NEOTROPICAL LYCÆNIDÆ.



E. C. Knight ad nat. del.

West, Newman chromo.

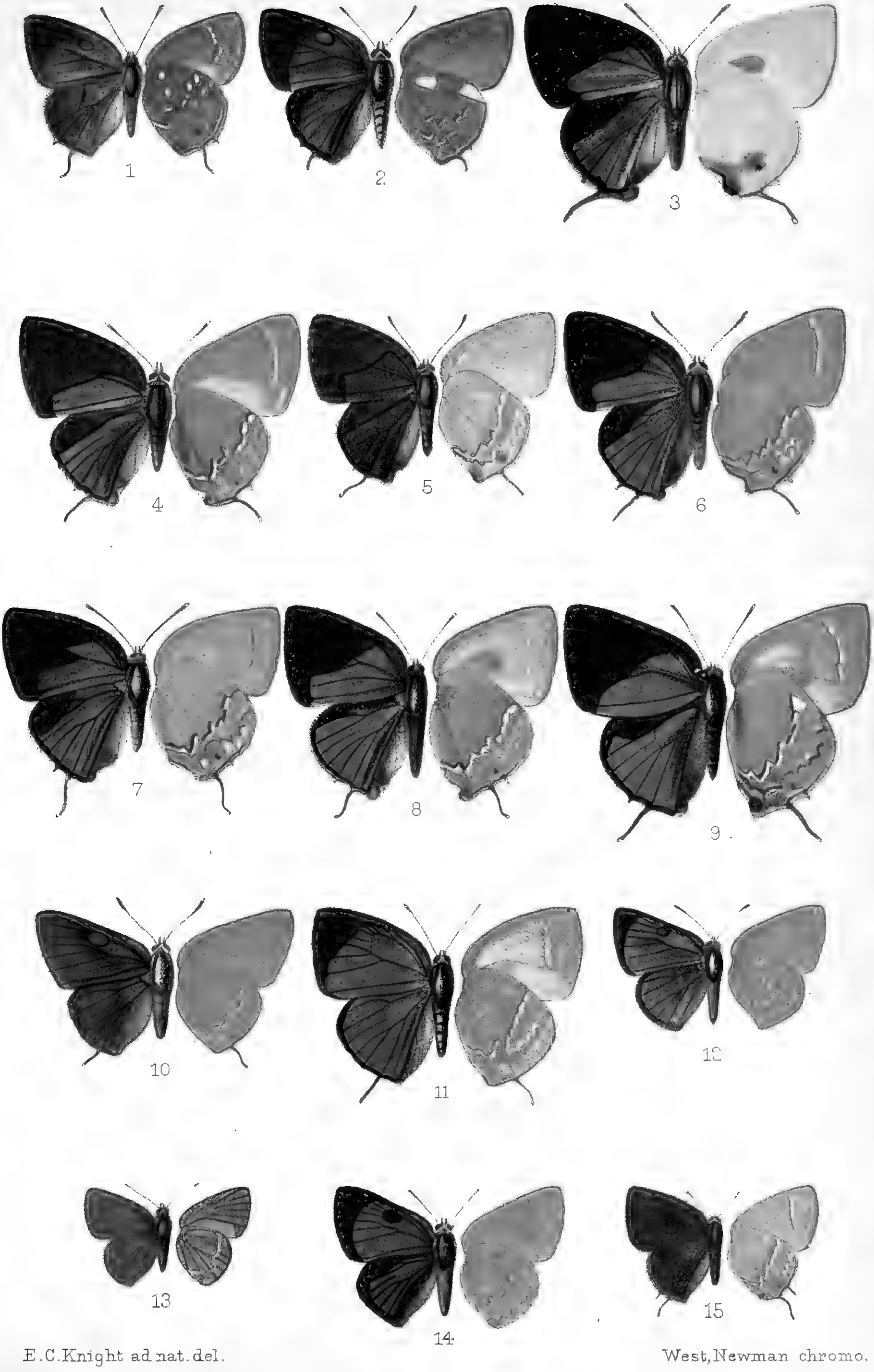
NEOTROPICAL LYCÆNIDÆ.



E.C. Knight ad nat. del.

West, Newman chromo

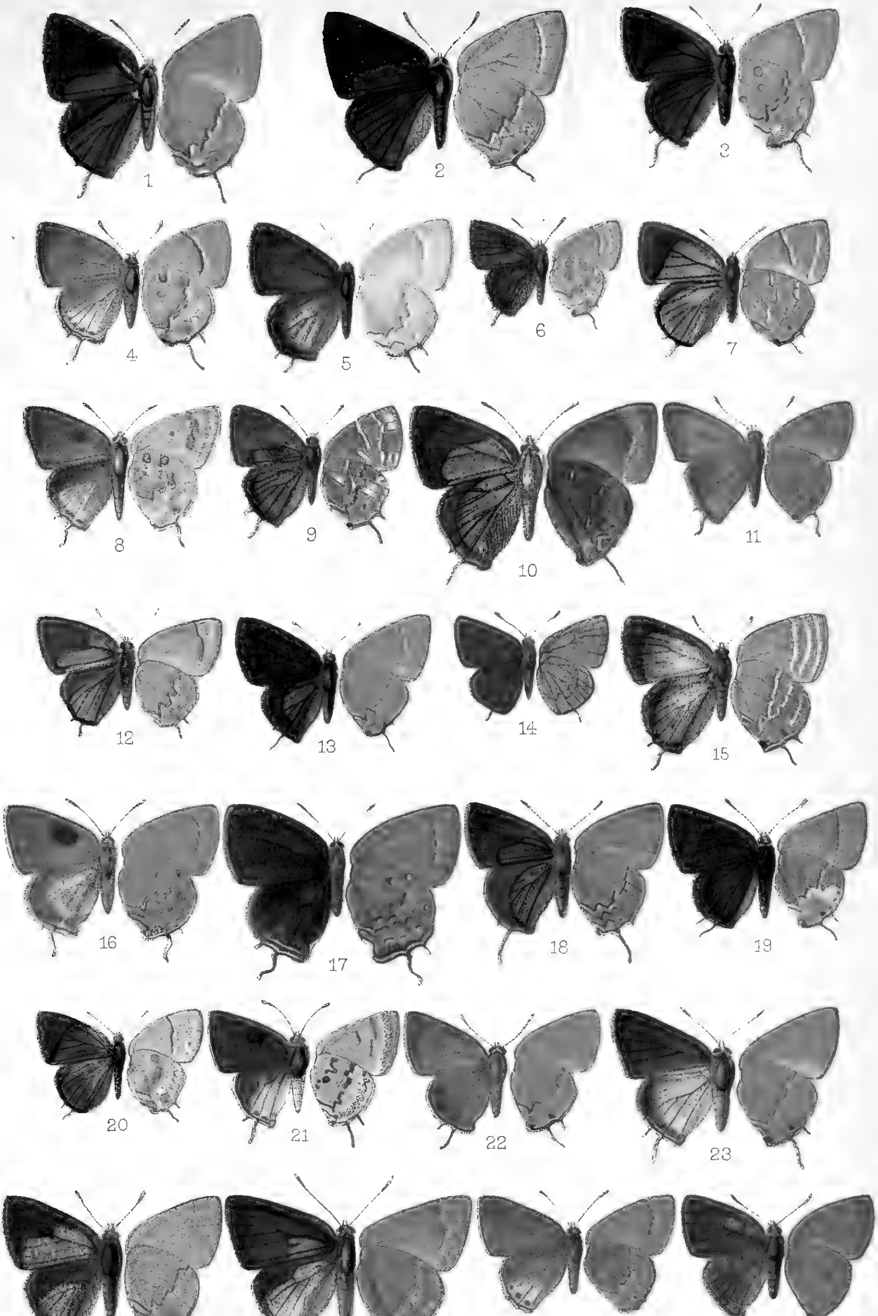
NEOTROPICAL LYCÆNIDÆ.



E. C. Knight ad nat. del.

West, Newman chromo.

NEOTROPICAL LYCÆNIDÆ.



E.C. Knight ad nat del. West, Newman chromo.

NEOTROPICAL LYCÆNIDÆ.

become fused and support the claws as found in the female), but at the same time they divided the genus into a number of sections. Many of these sections can be denoted by authors' existing names if thought fit by entomologists. Various views regarding the importance or otherwise of the brands continue to be put forward; and Dr. Hy. Skinner, Ent. News, April 1907, p. 131, in a paper intending to prove that the N. American *T. irus* and *T. henrici* are one species, states that "the male is often with or without the brand, which has no generic or specific value."

Before any satisfactory division into genera can be undertaken, it will be necessary to dissect and examine a large amount of material which at present is not available, many of the types being unique and large numbers of the species being represented in collections by but two or three examples.

In the present paper I have been able to clear up many points of synonymy, and have described and figured a large number of new forms. It will be noticed that some few of Hewitson's species are placed as synonyms of species previously described by him, and this can be accounted for by the fact that the types were from other collections and were returned to their owners, and that the insects seen by him later were not recognised as being already described.

I have examined a large number of the types, many of which are contained in the British Museum, and Mr. Godman has placed the whole of his collection in my hands for examination. This fine collection has been of the greatest help, in fact quite essential, containing as it does many of Hewitson's types, then in Bates's possession, in addition to the unrivalled series from Central America.

Mr. Grose Smith, who now has some of Hewitson's types described from the Saunders collection, has kindly allowed me to borrow the specimens for comparison.

Mr. Dukinfield Jones, who collected at Castro, Brazil, and some of whose captures were described by Mr. W. Schaus, has also kindly permitted me to examine these and has lent me others for description.

It is a fact worth noting that out of the large number of species described by Hewitson, only some 35 (nearly all the types of which are in the British Museum) are not represented in the various private collections I have examined.

The following species are included in the genus "*Thecla*" by Mr. Kirby in his Catalogue, but their identity is obscure. The numbers refer to his list:—

84 *a. Hesperia chiton* Fab. Described as with three tails. Donovan's figure shows it with two and a lobe. In my opinion without doubt = *T. phaleros* L., ♀, highly coloured. Dr. Butler, in his 'Catalogue of Fabrician Lepidoptera,' p. 198, thinks not. The type appears to be lost.

112. *Hesperia dindus* Fab. Type lost.
163. *Hesperia agrippa* Fab. There are two specimens in the British Museum identified by Dr. Butler from Jones's drawings. They are labelled "Honduras." They are not referred to in the 'Biologia Centrali-Americana' under that or any other name.
299. *Papilio ixion* Fab. In the British Museum there are two specimens so identified by Dr. Butler, but I know not on what authority. They are doubtfully distinct from *Thecla m-album* Bd.
300. *Papilio anacreon* Fab. Type lost.
308. *Hesperia romulus* Fab. Type lost. Donovan's figure is bad and might refer to almost any species with a green under side.
392. *Papilio thamyras* Linn.
469. *Papilio nigroflavus* Goeze.

The following species figured by Cramer and Stoll are unknown to me, and do not exist in any of the collections which I have examined. They are mostly from Surinam and probably came from the interior of the country, viz.:—

ethemon Cr.	*lycabas* Cr.
arogeus Cr.	*ematheon* Cr.
ismarus Cr.	*phalanthus* Cr.
bitias Cr.	*cethegus* Stoll.

The following species described by Godart I am unable to make out with certainty, and unless the types can be found, I fear they will never be satisfactorily identified. They were described by Godart in the genus *Polyommatus*, viz.:—

sinnis.	*strophius.*
bazochii.	*ergeus.*
nebis.	*megarus.*
gabelus.	

T. bazochii has been identified as = *T. thius* Hübn., but the description is much too vague to allow of any certainty on this point.

The following species are known to me only from the descriptions and figures, and are not contained in any of the collections which I have examined. They are noted here in chronological order:—

T. dion Schaller, Naturf. xxiii. p. 49, t. 1. ff. 9, 10. Figures too bad for identification.

T. umbratus Hübn. (possibly allied to *T. parthenia* Hew. which, as figured in B. C.-A., has a much shorter tail than Hewitson's figure). Locality given by Westwood and Hewitson in Gen. Diur. Lep. p. 485, is "Yucatan." Not mentioned by Messrs. Godman & Salvin in B. C.-A.

T. guacanagari Walleng.	Puna Is., Ecuador. Type Mus. Holm.
T. mœsites Herr.-Schäff.	Cuba.
T. acaste Prittw.	Brazil.
T. hirsuta ,,	,,
T. imma ,,	,,
T. megamede Prittw.	,,
T. antinous Feld.	Bogota.
T. nana ,,	,,
T. dinus Hew.	} Described from types in Boisduval's Collection.
T. arola ,,	}
T. gauna Boisd.	Costa Rica. Not referred to in Biol. Centr.-Amer.
T. thargelia Burm.	Argentina.
T. nanidion ,,	,,
T. phryniscа ,,	,,
T. peralta Mösch.	Surinam.
T. heloisa ,,	,,
T. lorea ,,	,,
T. fessa ,,	,,
T. bianca ,,	,,
T. aprica ,,	,,
T. devia ,,	,
T. thenca ,,	,,
T. promissa ,,	,,
T. tirrhæa ,,	Jamaica.
T. vulnerata Staud.	,,
T. adela ,,	Amazon.
T. (*Micandra*) *sapho* Staud.	Colombia.
T. alihoba Staud.	Allied to *T. aholiba* Hew. (*aritides* Schaus), but appears distinct.
T. oribata Weymer.	Bolivia. Described as allied to *T. oxidia* Hew. and *T. arria* Hew.
T. faga Dognin.	Ecuador.
T. joya ,,	,,
T. amatista ,,	,,
T. wernickei Rober.	Brazil.
T. sadiei Weeks.	Bolivia.
T. harrietta ,,	,,
T. francis ,,	,,
T. dickiei ,,	,,

Of the species described by Lucas in Sagra's 'History of Cuba' (1857), *T. celida* is contained in the Hewitson Collection, but *T. aon*, *T. tollus*, *T. paseo*, and *T. marius* I have not seen.

Of the species described by Mr. W. Schaus in the 'Proceedings' of the United States National Museum, vol. xxiv. (1902), and in which Museum the types are placed, examples of the following have been given by the author to the British Museum, viz. :—

T. taminella Schaus.	*T. foyi* Schaus.
T. rana ,, (=*T. argona* Hew.).	*T. tigonia* ,,
	T. guzanta ,,
T. binangula Schaus.	*T. polama* ,, ♀.
T. bolima ,,	

The specimens of *T. binangula* and *T. bolima* appear to be the two sexes of one species and are both labelled Castro, Parana. The type of *T. binangula* is described from Peru, so possibly there is some error here.

Examples of the following species are contained in Mr. Dukinfield Jones's Collection and were determined by Mr. Schaus, viz. :—

T. xorema Schaus.
T. muattina ,,
T. farmina ,, (=*dicæa* Hew.).
T. chilica ,,

Of the remaining species I am unable to make out with certainty the following :—

T. giapor Schaus.	*T. conoveria* Schaus.
T. carla ,,	*T. curtira* ,,
T. nugar ,,	*T. tella* ,,
T. atrana ,,	*T. chaluma* ,,
T. talama ,,	*T. echinita* ,,
T. normahal ,,	*T. guadala* ,,
T. malta ,,	*T. illex* ,,
T. vomiba ,,	*T. hostis* ,,
T. vieca ,,	*T. fostera* ,,
T. rickmani ,,	*T. lanckena* ,,
T. zurkvitzi ,,	*T. humber* ,,
T. epopeodes ,,	

Amongst the collections before me are specimens which appear from the descriptions to be referable to several of the above-named species, notably *T. nugar*, *T. guadala*, and *T. hostis*. These I have refrained from describing, but it is quite possible that when they are compared with the types they will prove to be distinct, and I hope on some future occasion to be able to examine these types.

Thecla.

Thecla splendor, sp. n. (Plate XXXI. fig. 4.)

Female. Allied to *T. tuneta* Hew.*, which it closely resembles on the upper side. On the under side it differs in possessing a curved, black, ultramedian band on the fore wing, inwardly edged with whitish, and in the median band on the hind wing

* *T. tuneta* Hew. Ill. D. Lep. p. 71, pl. 28. figs. 14, 15.

being broader, placed further from the base, more concave, and more sharply angled to the anal margin. There is also a submarginal indistinct dark shade which is not present in *T. tuneta* Hew.

Expanse $1\frac{9}{10}$ inch.

Hab. Colombia.

Type, Mus. Oxford, No. $\frac{1901}{1198}$. Collected 1848–1857 by H.M. Vice-Consul Edward W. Mark, and presented to the Museum in 1901 by Mr. F. W. Mark.

The type, which is the only specimen I have seen, is not in very good condition, having lost its antennæ and abdomen; but enough remains to show that it is a very distinct species, and I believe unnamed.

THECLA GABRIELA.

Papilio gabriela Cr. Pap. Exot. i. pl. 6. figs. C, D (1775) (nec Godart).

Mr. Godman's collection contains examples of this species from Ega. It is entirely without the patch of differently formed scales on the upper side of the fore wing, and is so figured by Cramer. It was so identified by Bates, and I believe quite correctly. Godart described it as having a large silky spot, and was followed by Hewitson in his determination.

THECLA SUMPTUOSA, sp. n. (Plate XXXI. fig. 3.)

Polyom. gabriela Godt. Enc. Méth. ix. p. 622, no. 18 (1823).

Thecla gabriela Hew. Ill. D. Lep. p. 72, pl. 27. fig. 7 (1865).

Male. Allied to *T. gabriela* Cr., but differs in possessing a large silky patch of differently placed scales on the fore wing, situated on the disc of the wing and extending below the median nervule but not into the cell. On the under side of the hind wing the dark band is outwardly bordered by a single white band varying in width, whilst in *T. gabriela* Cr. there are two distinct white bands.

Expanse $2\frac{1}{5}$ inches.

Hab. Espiritu Santo, Brazil (*Mus. Druce*); S. Paulo, Amazons (*Mus. Godman*), from Bates's Collection.

Type, Mus. Druce.

The specimen in the British Museum which was figured by Hewitson as *T. gabriela* Cramer is a representative of this species.

THECLA CANDIDUS, sp. n. (Plate XXXI. figs. 1 ♂, 2 ♀.)

Male. Allied to the preceding, *T. sumptuosa*, but differs in the silky patch being produced along the lower wall of the cell almost to the base. On the under side the black markings are clear and distinct, and there is a good deal more black towards the apex of fore wing.

Female. On the upper side the apex of the fore wing is broadly black, and there is a large oval spot at the anal angle of the hind wing. On the under side the anal angle of the hind wing is very heavily marked with bright red, in the centre of which are two blackish spots.

Expanse, ♂ $2\frac{1}{10}$, ♀ $3\frac{3}{10}$ inches.

Hab. Rio Minero, Muzo, Colombia, 2500 feet (*Wheeler*).

Types, Mus. Godman.

The differently shaped silky patch on the fore wing of the male serves to distinguish this insect from its allies.

THECLA ORNATRIX, sp. n. (Plate XXXI. fig. 5 ♂.)

Male. Allied to the preceding, *T. candidus*, rather less brilliant and with the silky discal patch arranged much as in that species, but with the addition of a large, elongate, separate patch occupying the outer half of the cell. On the under side of the hind wing the black band is divided by a sinuous whitish band from the costa.

Female. On the upper surface the wings are dull brown, with the discal areas suffused with dull blue, and on the under surface the basal areas only are green.

Expanse $2\frac{1}{10}$ inches.

Hab. Rio Demerara, British Guiana.

Types, Mus. Druce.

Also allied to *T. sponsa* Mösch. Verh. zool.-bot. Ges. Wien, xxvi. p. 298, pl. 3. fig. 2, but has many points of distinction.

THECLA FLORALIA, sp. n. (Plate XXXI. fig. 6.)

Male. Allied to *T. tagyra* Hew.*, with the silky patch on the fore wing not extending over the upper half of the cell of the fore wing as in that species, but is distinctly bordered by its walls and running along the median nervure halfway to its base.

Expanse $1\frac{9}{10}$ inch.

Hab. Maranham (*Belt*).

Type, Mus. Godman.

Differs only from *T. tagyra* in the position and extent of the silky patch. Staudinger has figured this insect as *T. tagyra* in his Exot. Schmett. (1888).

THECLA DORCAS, sp. n.

Male. Allied to *T. damo* Druce, and, like that insect, with a linear black margin only, but with the apical and outer marginal areas much darker and richer blue.

Female. Differs from that sex of *T. damo* in having narrower brown margins to both wings on the upper side.

Expanse as *T. damo*.

Hab. Vina, N.W. Peru, 5500 feet (*O. T. Baron*).

Types, Mus. Godman.

This insect, which by some entomologists would be doubtless considered as a subspecies of *T. marsyas* Linn., differs from

* *Thecla tagyra* Hew. Ill. D. Lep. p. 73, pl. 28. figs. 20, 21.

T. damo in the same way as *T. cybele* G. & S.* differs from typical *T. marsyas*.

THECLA TROCHUS, sp. n. (Plate XXXI. fig. 7.)

Male. Allied to *T. eronos* mihi †. Upper side brilliant shining green, with the apex and outer margin of fore wing black. Under side: ground-colour paler than in *T. eronos*, with the metallic greenish-blue suffusion confined more to the lower discal areas in the fore wing; the ultramedian line much shorter on the fore wing, and with a distinct dark red, black-pupilled, submarginal lunule between the lower median nervules on the hind wing

Expanse $1\frac{3}{10}$ inch.

Hab. Rio Minero, Muzo, Colombia, 2500 feet (*Wheeler*).

Type, Mus. Godman.

Both *T. eronos* and *T. trochus* belong to a group which has not been found in Central America, but in appearance are much like *T. heraclides* Godman & Salvin, but have however no tails and no trace of a brand. I have figured the type of *T. eronos* on Pl. XXXI. fig. 9.

THECLA VIRESCO, sp. n.

Male. Allied to *T. lisus* Stoll ‡, and, like that species, has no brand, but the upper side is a dark brilliant green and the borders are wider and less distinctly abrupt. On the under side the markings are much the same, but the whole of the fore wing is suffused with brilliant opalescent green excepting towards the apex, and the ultramedian line is almost obsolete. The under side of the abdomen is pale straw-colour.

Expanse $1\frac{3}{10}$–$1\frac{3}{5}$ inch.

Hab. Maranham.

Type, Mus. Godman.

I have compared this and the following species to *T. lisus*, but, although the markings are much the same, they present a more robust appearance.

THECLA PHOTEINOS, sp. n. (Plate XXXI. fig. 8.)

Male. Allied to *T. viresco* mihi, but upper side brilliant shining indigo-blue and fore wing below opalescent blue in place of green.

Expanse $1\frac{4}{5}$ inch.

Hab. Quonga, British Guiana (*H. Whitely*).

Type, Mus. Godman.

THECLA CRINES, sp. n. (Plate XXXII. figs. 1 ♂, 2 ♀.)

Male. Upper side: shining purple-blue, colour of *T. paphlagon* Feld. Fore wing: apex and cilia narrowly black, a square brown band occupying the further end of the cell. Hind wing: the

* *Thecla cybele* G. & S., P. Z. S. 1896, p. 516.

† *Thecla eronos* H. H. Druce, Ent. Mo. Mag. 1890, p. 151.

‡ *Papilio lisus* Stoll, Supp. Cr. pl. 38. figs. 2, 2 *b* (1790).

costal margin narrowly dark brown. The anal angle to the base of the tail is rather broadly black, with a distinct bright green anteciliary line and a green crescent-shaped spot on the inner portion of the lobe. The under side is brownish black, darkest on the hind wing and towards the centre of the fore wing; the basal areas of both wings are broadly shining emerald-green, and there are four narrow shining green ultramedian lines on the hind wing, the anteciliary line being the most prominent.

Female. Upper side dull shining slaty blue, with apex and outer margins brownish black; hind wing with the green anal markings as in male. Under side paler than in male, with the green lines of the hind wing (excepting the anteciliary line which is prominent as is also the green above the black lobe) almost obsolete; the basal areas of both wings are entirely without the green.

Expanse, ♂ $1\frac{1}{5}$–$1\frac{2}{3}$ inch, ♀ $1\frac{1}{2}$ inch.

Hab. Colombia, Rio Minero, Muzo, 2500 feet (*Wheeler*); Bogota (*Mus. Druce & B.M.* ex *coll. Crowley*).

Types, Mus. Godman.

Perhaps nearest to *T. hemon* Cr.*, but not very nearly allied. The brand is smaller and more prominent.

THECLA NUMEN, sp. n. (Plate XXXII. figs. 4 ♂, 5 ♀.)

Male. Upper side: fore wing and basal half of hind wing opalescent greenish blue, deepest towards base. Fore wing with the costa narrowly and the apex and outer margins more broadly black. Hind wing with a dark mark at the apex and a dark mark between the nervules near the anal angle, with its outer half white and the dark stripes of the under side showing through distinctly. Under side with prominent white and brown stripes arranged as in *T. phydela* Hew.†, but more prominent and without the short white band which commences on the costa near the base on the hind wing; the yellow area at the anal angle is less, being confined between the lower median nervules. Cilia of both wings pure white on both surfaces. A linear dark brown glandular patch on base of lower median nervule of fore wing occupying about half its length from its origin to outer margin.

Female. Upper side pure white, with the costa, apex, and outer margins broadly brownish black, as is also the outer margin of hind wing which, however, encloses a distinct white line just within the black anteciliary line. Under side as in male, but inner margin of fore wing more broadly white on the disc. Cilia of both wings brownish on both surfaces, but whitish towards anal angle of hind wing.

Expanse, ♂ $1\frac{9}{10}$, ♀ $1\frac{4}{5}$ inch.

Hab. Roraima, British Guiana (*H. Whitely*).

Types, Mus. Godman.

The type specimens are the only ones I have seen of this

* *Papilio hemon* Cr. Pap. Exot. i. pl. 20. figs. D, E (1775).

† *Thecla phydela* Hew. Ill. D. Lep. p. 84, pl. 33. figs. 54–56.

beautiful species. They are in fine condition. It is a much larger insect than *T. phydela*, and in colour it resembles *T. gibberosa* Hew.

THECLA AMPLITUDO, sp. n. (Plate XXXII. fig 6.)

Male. Differs only from *T. ægides* Feld. in the black borders being about half as wide and in the blue being of a decided violaceous hue.

Expanse $1\frac{4}{5}$ inch.

Hab. St. Jago, Ecuador (*Buckley*).

Type, Mus. Godman.

There are three males in Mr. Godman's collection. It doubtless takes the place of the Colombian *T. ægides* in Ecuador.

THECLA BARBA, sp. n. (Plate XXXII. fig. 3.)

Male. Upper side: uniform brilliant shining blue, with the costa, apex, and outer margins black. Under side rich chestnut-brown, shading to pale greyish along the inner margin of fore wing. A distinct inwardly-black-bordered white line crosses the fore wing obliquely about the middle from the costa to the lower median nervule. There is a similar line on the hind wing much angled below the centre and then running to the anal margin; beyond this is a submarginal line composed of whitish lunules outwardly bordered with black. At the anal angle there is a small black spot above which are dusted grey scales. Cilia reddish brown on both surfaces, whitish at anal angle where they appear to be tipped with black.

Expanse $1\frac{1}{2}$ inch.

Hab. Rio Minero, Muzo, Colombia, 2500 feet (*Wheeler*).

Type, Mus. Godman.

Perhaps allied to *T. cyda* G. & S.*, but is quite different below. It is without a brand.

THECLA PAUPERA.

Pseudolycæna paupera Felder, Reise Nov., Lep. ii. pl. 31. fig. 15, ♀.

Hab. Bogota, Colombia (*Felder & B.M.*).

The British Museum Collection contains a pair (♂ ♀) of this rare species, which are the only examples I have seen.

The upper side of the male is a uniform dark shining green, with narrow black margins and without any dark patch of scales or brand on the fore wing. On the under side the dark bands are rather narrower and less distinct than in the female, which is described and well figured by Felder.

THECLA HARRIETTA.

Thecla harrietta Weeks jun., 'Canadian Entomologist,' xxxiii. no. 11 (1901); Ill. Diur. Lep. p. 45, pl. 11. fig. 2 (1905).

Hab. Bolivia (*Weeks*).

* *Thecla cyda* G. & S., B. C.-A., Lep. Rhop. vol. ii. p. 28, pl. 53. figs. 15, 16 (1887).

This insect appears to be very closely allied to *T. paupera* Feld., and the markings of the under side seem to be much the same, but on the upper side the wings are described as dark lustrous blue with the basal area of the fore wing dusted with greenish blue.

It is known to me only by Mr. Weeks's description and figures.

THECLA COMÆ, sp. n. (Plate XXXII. figs. 8 ♂, 9 ♀.)

Male. Allied to *T. ion* mihi *, from which it differs on the upper side by having somewhat wider dark outer marginal borders, and on the under side in the fore wing being entirely without the large opalescent blue patch on the discs. The hind wing differs from that of *T. ion* in the third transverse pale blue line (counting from the base) being without the thick blue dusting on its outer border.

Female. Much the same as male above, but black margins are broader and on the under side the ground-colour is paler and redder.

Expanse $1\frac{9}{10}$ inch.

Hab. Rio Minero, Muzo, Colombia, 2500 feet (*Wheeler*).

Types ♂ ♀, Mus. Godman.

There is also a male in the Hewitson cabinet (where it is placed with *T. œgides* Feld.), but without locality.

Careful examination reveals a large elongate oval patch of differently placed scales, situated over the outer half of the cell and beyond, on the fore wing of the male of both this species and of *T. ion*. *T. œgides* is entirely without this patch. I have figured the type of *T. ion* on Pl. XXXII. fig. 7.

THECLA PLATYPTERA.

Pseudolycæna platyptera Felder, Reise Nov., Lep. ii. p. 246, pl. 28. figs. 6, 7 (1865).

Micandra platyptera Staud. Exot. Schmett. p. 288, pl. 97.

Recorded by Felder from Venezuela and Bogota. The type from Venezuela is now in Mr. Godman's collection and was formerly in the Kaden Collection. As figured by Staudinger in his Exot. Schmett. (from Peru), it is smaller, and the lines on the hind wing below are somewhat different and no dusting of white scales is shown. Schatz has made it the type of his genus *Micandra.* A close examination of the tarsus of the fore leg shows that the fusion of the joints is very complete and that there is an entire absence of claws, whilst the lower surface supports a double row of large spines set close together. The female is unknown. *M.* (?) *sapho* Staud. id. p. 289, pl. 97, stated on the plate to be a male and in the letterpress to be a female, is probably not closely allied, if indeed it belongs to the same group of the Lycænidæ. I have never seen a specimen. It was received from the San Juan River, Colombia.

* *Thecla ion* H. H. Druce, Ent. Mo. Mag. 1890, p. 151.

THECLA CHLAMYDEM, sp. n. (Plate XXXII. fig. 10.)

Male. Allied to *T. auda* Hew., but blue areas above are of an indigo shade, and the costal margin of fore wing and apex, outer margin, and anal angle of hind wing are much more broadly black. On the under side the arrangement of the linear transverse markings is much the same, but the two outer whitish shades are more prominent in both wings, and on the hind wing the discal markings appear to be doubled or dusted inwardly with whitish scales.

Expanse $1\frac{2}{5}$ inch.

Hab. Pozuzo, Peru, 5000–6000 feet.

Type, Mus. Druce.

THECLA THARA.

Thecla thara Hew. Ill. Diur. Lep., Lycænidæ, p. 83, pl. 32. figs. 45, 46, ♂.

Thecla ivelia Gosse, Entomologist, vol. xiii. p. 205, pl. 2. fig. 3, ♀.

Hab. Rio de Janeiro (*Hew.*); Paraguay (*Gosse*).

There is no doubt that Gosse has described the female. His type, which is now in the British Museum, is in bad condition and stained, but enough of it remains to prove that it is *T. thara* Hew. The figure given in the 'Entomologist' is a bad one.

THECLA ANNA, sp. n. (Plate XXXIII. fig. 2.)

Male. Upper side brilliant shining light blue, with the costa narrowly and the apex and outer margin of fore wing and the apex and outer margin of hind wing broadly brownish black. Underside—Fore wing pale opalescent blue, richest towards the centre of the disc; the costa, apex, outer and inner margins brownish grey; the apex and outer margin dusted with whitish scales. Hind wing: ground-colour brown, mottled irregularly with dark brown and more especially towards the anal angle with yellow blotches, the whole ground being dusted with whitish scales; a paler blotch near the middle. Thorax above bluish, covered with bluish hairs, as are the wings towards the abdominal margin, below brown. Cilia on both surfaces reddish brown. Abdomen reddish. Legs brown, white-spotted. Palpi black, thickly clothed with hairs; the terminal joint very small.

Expanse $1\frac{9}{10}$ inch.

Hab. Interior of Colombia (*Wheeler*).

Type, Mus. Godman.

This beautiful species is not nearly allied to any described and belongs to a group by itself. It is without any brand or silky patch. The type appears to be slightly torn towards the anal angle of hind wing, so that the figure does not represent it in quite its natural perfect state.

THECLA CANDOR, sp. n. (Plate XXXIII. fig. 1.)

Male. Allied to *T. loxurina* Feld., and with the small black brand on fore wing as in that species, but smaller, and on the upper side with the blue areas darker and more extensive. On the under side the basal half of the fore wing is plain greyish brown, not dusted with red as in *T. loxurina.*

The shape of the hind wing is entirely different, the anal angle being produced to form one short broad tail without any projecting lobe. The tail is dark reddish brown, and this brown colour runs partially along the anal margin.

Expanse $1–1\frac{1}{10}$ inch.

Hab. Huancabamba, N. Peru, 6000–10,000 feet.

Type, Mus. Druce.

We have several specimens agreeing with each other, and I have found two in the Hewitson cabinet in the British Museum, labelled Ecuador and placed with *T. atymna* Hew., which is another species with a distinct lobe-like appendix.

THECLA HYBLA, sp. n. (Plate XXXIII. fig. 4.)

Male. Upper side uniform shining greenish blue, with the apex and outer margin of fore wing broadly and costal margin to cell-wall brownish black. Apex of hind wing brownish black, gradually narrowing to anal angle. Under side—Fore wing brownish grey with a darker ultramedian band and some marginal shades; the lower discal area is shining olivaceous, and from the base reaching to the junction of the median nervules and partially into the cell is a streak of opalescent greenish blue. The hind wing is pale greyish with darker mottlings and marbled with dark red towards the base and outer margin, and with a central red zigzag line from the costa to the abdominal margin. The palpi are clothed with long hairs and the terminal joint is very small and completely covered by them. There is no brand on the fore wing.

Expanse $1\frac{3}{5}$ inch.

Hab. Ecuador.

Type, Hew. Coll. British Museum.

Allied to *T. arria* Hew.*, but larger, bright blue above, and the marbling on the hind wing below red, not brown, and differently placed.

THECLA TYRRIUS, sp. n. (Plate XXXIII. fig. 3.)

Male. Upper side uniform dull blackish brown with the basal areas, more especially on the hind wing, pale shining blue. An elongate, paler brand at the end of the cell in the fore wing. Under side brownish grey; hind wing dusted with dark red scales, and with red linear markings arranged much as in *T. mirma* Hew.†; on the fore wing, which has an ultramedian and a submarginal lunular line, is a discal streak of pale opalescent blue,

* *Thecla arria* Hew. Ill. Diur. Lep. p. 213, pl. 85. figs. 729, 730.

† *Thecla mirma* Hew. Ill. Diur. Lep. p. 212, pl. 85. figs. 718–720.

clearest at the base and becoming obsolescent along the inner margin.

Expanse $1\frac{1}{20}$ inch.

Hab. Ecuador.

Type, Hew. Coll. British Museum.

Probably not very nearly allied to *T. mirma* as that species is without a brand.

This and the preceding *T. hybla* were placed at the end of the series of *Thecla* by Hewitson, and he would doubtless have named them had he been able to do so.

THECLA ALATUS, sp. n.

Male. Upper side pale blue of pinkish-brown tinge, opalescent, with costal, apical, and outer margins blackish brown. Cilia of both wings uniformly reddish. A small pale brand at end of cell of fore wing. Under-side markings and colour much as in *T. culminicola* Staud. Cilia uniformly reddish.

Expanse $1\frac{1}{5}$ inch.

Hab. Cajamarca, N. Peru, 11,500 feet (*O. T. Baron*).

This may prove to be the same as *T.* (?) *culminicola* Staud. (Iris, vii. pl. 2. fig. 6, 1894), but it is without the chequered fringes and has an even dark border to the fore wing above. One specimen before me is without the orange on the disc of the fore wing below and the pale blotches of the hind wing are also absent.

THECLA SPURIUS.

Pseudolycæna spurius Feld. Reise Nov., Lep. ii. p. 250, pl. 31. figs. 23, 24 (1865).

Thecla dolosa Staud. Exot. Schmett. p. 286, pl. 97 (as *dolylas* Cr.) (1888).

Both described from Venezuela. Staudinger compares his species with Cramer's *dolylas*, but does not mention *P. spurius* Feld. They are certainly the same species. Mr. Kirby in his Catalogue (p. 385) considered *T. spurius* synonymous with *dolylas*.

THECLA TALAYRA Hew., var. CASTITAS, nov.

Male. Differs from typical *T. talayra* Hew.* in the blue upper surface being duller in tone and in having broader black apical margins. On the under side the ground-colour is pale grey in place of pure white, and the anal angle of the hind wings is more heavily marked with red.

Hab. Pará (*B. M. Coll.*); Espiritu Santo, Brazil (*Hew. Coll. B. M.*).

This may prove to be a distinct species, as it has a very different appearance below. The Hewitson Collection contains two specimens which were placed with *T. beera* Hew., an insect which has a large brand on the fore wing.

* *Thecla talayra* Hew. Desc. Lyc. p. 1 (1868).

THECLA EXIGUUS, sp. n. (Plate XXXIII. fig. 5.)

Male. Differs from *T. beera* Hew.* in being without the brand and in the outer margin of fore wing being straight. Upper side shining indigo-blue, greenish on the hind wing. Fore wing: apex and outer margin rather broadly black. Hind wing: costal margin and apex black, narrowing towards anal angle; abdominal fold pale grey. A minute red spot at anal angle. Under side much as in *T. beera*; markings more slender; linear band on fore wing bent outwardly from costa.

Expanse $1\frac{1}{10}$ inch.

Hab. Surinam.

Type, Mus. Druce.

THECLA CASTIMONIA, sp. n. (Plate XXXIII. fig. 6.)

Male. Upper side rich purple-blue, much like *T. beera* Hew., but without any brand on the fore wing and with very narrow black apex and linear black outer margins. A distinct red spot at anal angle. On the under side the ground-colour is paler; the markings, which are arranged as in *T. beera*, are more slender and the red areas are more restricted.

Expanse $1\frac{1}{5}$ inch.

Hab. Interior of Colombia (*J. Carder*).

Type, Mus. Druce.

Distinguished by the absence of a brand and the very narrow black margins.

THECLA ATENA.

Thecla atena Hew. Ill. Diur. Lep. p. 92, pls. 37, 38. figs. 93, 101.

Mr. Godman's collection contains a good series and we have specimens from Espiritu Santo, Brazil. The variety referred to by Hewitson is now in Mr. Godman's collection and is quite an ordinary form.

THECLA GEBA.

Thecla geba Hew. Ill. Diur. Lep. p. 198, pl. 79. figs. 641, 642 (1877), ♂.

This species, as stated, is very near to *T. atena* Hew., the principal difference being the more extensive band on the posterior wing below. The type, which has been kindly lent to me by Mr. Grose Smith, is, so far as I am aware, unique, and its habitat has not been recorded.

THECLA MELLEUS, sp. n. (Plate XXXIII. fig. 7.)

Male. Allied to *T. atena* Hew., but the blue areas are much less brilliant and less extensive, being confined to the basal half on the fore wing; it has also a broad black apex and outer margin on the hind wing. The under side is marked as in *T. atena*. The

* *Thecla beera* Hew. Ill. Diur. Lep. p. 151, pl. 59. figs. 390, 391 (1874).

brand on the fore wing above is in the same position as in *T. atena*.

Expanse $1\frac{3}{5}$ inch.

Hab. Rio Minero, Muzo, Colombia, 2500 feet (*Wheeler*).

Type, Mus. Godman.

Although the markings on the under side do not differ from those of *T. atena*, the upper side is so different that I venture to separate it.

THECLA FLOREUS, sp. n. (Plate XXXIII. fig. 8.)

Male. Closely allied to the preceding, *T. melleus*, with the blue areas on the upper side slightly more extensive, but of a brilliant shining hue, that of the hind wing being paler. On the under side the markings are much the same, but the ground-colour is darker and plumbeous, the outer margins of both wings are distinctly cupreous, and the broken white linear band on the hind wing is much less angled. Brand as in *T. atena* Hew.

Expanse $1\frac{3}{10}$ inch.

Hab. Tapajos, Amazons (*Bates*).

Type, Mus. Godman.

Doubtless considered by Bates as distinct, as it has one of his labels attached but without a name.

THECLA GEMMA, sp. n. (Plate XXXIII. fig. 9.)

Male. Allied to *T. minyia* Hew.; brand in same position but oval in shape. Upper side: the purple areas of about equal extent, but deeper in tone. Under side: ground colour deeper in colour with red basal blotches as in *T. minyia*, but without the double white blotch on the costa of fore wing adjoining the red basal blotch, and with an additional red blotch on the hind wing situated at the base of the abdominal margin.

Expanse $1\frac{2}{5}$ inch.

Hab. Rio Napo, Peru (*Whitely*).

Type, Mus. Godman.

Appears quite distinct from any described species.

THECLA PORTHURA, sp. n. (Plate XXXIII. fig. 10.)

Male. Allied to the preceding, *T. gemma*, but with the brand circular and the black apical area of fore wing above rather more extensive. Under side: ground colour of hind wing is dark straw-colour, in great contrast to the plumbeous brown of that of the fore wing, which has the white oblique central band inwardly edged with black; there is a short, broad, red costal dash at the base of the fore wing and a similar but larger dash at the base of the hind wing, adjoining which is an eye-like marking, formed of a jet-black spot almost encircled by a white ring with some bluish scales. The medial and anal markings are prominent, and there is an extra small spot above the apex close to the margin.

Expanse $1\frac{1}{2}$ inch.

Hab. Bogota, Colombia (*Wheeler*).

Type, Mus. Godman.

A very beautiful species with many points of distinction.

THECLA RAVUS, sp. n. (Plate XXXIII. fig. 12.)

Male. Allied to *T. minyia* Hew., with the brand circular and smaller. Upper side with the blue areas paler, more saturated and somewhat less extensive. Under side uniform russet-brown shading to dark greyish towards the disc of the fore wing and broadly pale grey along its inner margin. On the fore wing is an oblique central whitish band, commencing on the costa (where it is broadest) and ending about the centre of the disc. On the hind wing, near the costa and towards the base, is a small, distinct, white spot edged inwardly with black; an ultramedian sinuous line also inwardly edged with black; a dark spot at the extreme anal angle and above this patches of bluish and yellowish dusted scales. Abdomen greyish above, pale below. Frons russet-brown.

Expanse $1\frac{3}{5}$ inch.

Hab. Amazons (*Wallace*).

Type, British Museum.

THECLA COLOR, sp. n. (Plate XXXIII. fig. 11.)

Male. Form, size, and general appearance of *T. athymbra* Hew., but blue brighter and more clearly defined without any brands as in that species, but on holding the insect before a strong light, a large dark patch can be discerned occupying the outer half of the cell of the fore wing. Under side much paler, the pinkish basal areas scarcely discernible, and an additional ultramedian linear band of lunules in the fore wing.

Expanse $1\frac{1}{5}$ inch.

Hab. British Guiana (*Whitely*).

Type, Mus. Druce.

There are also two specimens in Mr. Godman's collection captured by Whitely at Aunai, on the Essequibo River, in the same country.

This is an interesting species and, although it is without the distinct double brand of *T. athymbra*, is probably allied to it.

THECLA AMPLUS, sp. n. (Plate XXXIII. fig. 13.)

Male. Allied to *T. ophelia* Hew.* Brand smaller, black, and much less prominent. Upper side: blue areas more extensive, of a more purple hue and less shining. Under side differs from that of *T. ophelia* in the red basal blotches being much reduced, so that the margins of the wings only are red, in having a distinct median costal spot on the hind wing outwardly edged with white, and in the marginal spot between the submedian nervule and the lower median nervule, which in *T. ophelia* is always black, being thickly dusted with light bluish scales.

* *Thecla ophelia* Hew. Ill. Diur. Lep. p. 110, pl. 46. figs. 209, 210.

Expanse $1\frac{3}{5}$ inch.
Hab. Cucuta, Venezuela.
Type, Mus. Druce.
Also allied to *T. hypsea* G. & S.*, from which it differs in several particulars.

THECLA AURORA, sp. n.

Male. Allied to *T. sista* Hew.; blue areas of upper side lighter, brighter, and extending on the fore wing well beyond the large silky brown patch over the end of the cell. On the under side the ground-colour is very pale and the markings are much as in *T. sista.*
Expanse $1\frac{3}{10}$ inch.
Hab. Espiritu Santo and Rio Grande, Brazil.
Type, Mus. Druce.
Several specimens showing no variation.

THECLA ARMILLA, sp. n.

Male. Allied to *T. janthina* Hew., but with the fore wing less elongate and with the small silky patch situated on the median nervure at the end of the cell rather more prominent. On the under side the ground-colour is darker and the markings are much as in *T. janthina.*
Expanse $1\frac{1}{10}$ inch.
Hab. Rio de Janeiro, Brazil.
Type, British Museum.
This insect in size and form is like *T. sista* Hew., but is without the large indistinct brand of that species, whilst in coloration it resembles *T. janthina.* There are two specimens in Mr. Godman's collection, which were formerly in the Kaden Collection. They are without locality.

THECLA CYDONIA. (Plate XXXIII. fig. 14.)

Thecla cydonia H. H. Druce, Ent. Mo. Mag. xxvi. p. 152 (1890).
Hab. Colombia, Mus. Druce. Santa Marta and Interior of Colombia (*Wheeler*), Mus. Godman.
I have figured the type of this beautiful species.

THECLA FLOSCULUS, sp. n. (Plate XXXIII. fig. 15.)

Male. Allied to *T. armilla*, but with the blue areas much more extensive, of a dark purple hue and not so brilliant. Under side: ground-colour greyer with the markings, which are much as in *T. sista*, clearly defined.
Expanse $1\frac{1}{10}$ inch.
Hab. Espiritu Santo, Brazil.
Type, Mus. Druce.
On the upper side this insect has quite a different appearance from any of its allies.

* *Thecla hypsea* G. & S., B. C.-A., Rhop. vol. ii. p. 38, pl. 52. figs. 20, 21.

THECLA SELIKA.

Thecla selika Hew. Ill. Diur. Lep. p. 170, pl. 67. figs. 484, 485 (1874).

Hab. Theresopolis, Brazil (*B. M.*); Castro, Parana (*E. D. Jones*).

Mr. E. D. Jones has several specimens of this species, which is rare in collections. It is doubtless allied to *T. m-album* * Boisd., but the blue areas on the upper side are much more extensive and there are differences below.

THECLA STIKTOS. (Plate XXXIV. fig. 1.)

Thecla stiktos H. H. Druce, Ent. Mo. Mag. xxvi. p. 151 (1890).

Hab. Colombia.

The figure is taken from the type.

THECLA STIGMATOS. (Plate XXXIV. fig. 2.)

Thecla stigmatos H. H. Druce, Ent. Mo. Mag. xxvi. p. 152 (1890).

Hab. Colombia.

This and the preceding species were both captured by Mr. J. Carder, when on an orchid collecting expedition in the interior of the country, and so far as I can ascertain remain unique.

THECLA VIBIDIA.

Thecla vibidia Hew. Ill. Diur. Lep. p. 119, pl. 49. figs. 242, 243; Godm. & Salv. B. C.-A., Rhop. ii. p. 44, pl. 53. figs. 13, 14.

Thecla socigena Hew. l. c. p. 205, pl. 82. figs. 681, 682.

After a careful examination of the type of *T. socigena*, kindly lent me by Mr. Grose Smith, I find that there are no points whereby it can be distinguished from the previously described *T. vibidia*. In the figure of *T. socigena* the brand appears to be closer to the costal margin than in *T. vibidia*, but this is not so in the specimen from which the figure was drawn.

THECLA CHLAMYS, sp. n. (Plate XXXIV. fig. 3.)

Male. Allied to *T. lyde* G. & S., but with a small red spot at the anal angle above. Colour of *T. ligurina* Hew. On the under side it closely resembles *T. lyde*, but the ground-colour is more pearly, the red spots on the hind wing are less prominent, and the inner whitish line is less sinuous.

Female. Upper side brown, slightly greyish blue on the discs, and a small red spot at the anal angle. Under side as in male but is paler.

Expanse $1\frac{3}{10}$ inch.

Hab. S. Paraguay (*Perrens*).

Types, Mus. Godman.

Distinguished at once from *T. lyde* by its colour.

* *Thecla m-album* Boisd. & Leconte, Lép. Amér. Sept. pl. 26.

THECLA BUCCINA, sp. n. (Plate XXXIV. fig. 4.)

Male. Allied to *T. voltinia* Hew.; brand more circular. Colour approaches that of *T. ligurina* Hew., but more steely; on the under side the ground-colour is a warmer shade of brown, and the inner white line on the hind wing appears to be nearer to the outer margin.

Expanse $1\frac{1}{2}$–$1\frac{7}{10}$ inch.

Hab. Chapada (*H. H. Smith*), Tapajos (*Bates*), Brazil.

Type, Mus. Godman.

This insect was separated by Bates from its allies, but it does not appear to have been described.

THECLA NITOR, sp. n. (Plate XXXIV. fig. 5.)

Male. Allied to *T. punctum* Herr.-Schäff.*, which it resembles on the upper side. On the under side the ground-colour is rich plumbeous; there are no markings on the fore wing, and on the hind wing the inner white linear band is very prominent and less inclined to break up into spots; the submarginal row of spots is almost obsolete and the red patches are much reduced; the extreme base of the hind wing also is red.

Expanse $1\frac{1}{2}$ inch.

Hab. Ega, Amazons (*Bates*).

Type, Mus. Godman.

This may prove to be but an aberration of *T. punctum*, but it is so different in appearance on the under side that I venture to name it.

THECLA MUREX, sp. n. (Plate XXXIV. fig. 6.)

Male. Allied to *T. mycon* G. & S.† On the upper side the brown brand in the cell is much larger, the blue areas are much duller and darker, and the apex and outer margin of fore wing are broadly black. On the under side the ground-colour is lighter and the linear band on the hind wing is less angulated.

Expanse $1\frac{1}{5}$ inch.

Hab. Rio Grande, Brazil.

Type, Mus. Druce.

Doubtless the southern representative of *T. mycon.*

THECLA CANINIUS, sp. n.

Male. Allied to *T. thyesta* Hew. Upper side: fore wing dark brown, with a black brand at the end of the cell followed by a smaller, paler brand, the inner margin only pale opalescent blue; hind wing opalescent blue with the costal half dark brown. Under side: ground-colour paler, marked much as in *T. thyesta*, but the linear markings fainter and apparently nearer to the outer margins and without the whitish shading towards the anal angle.

Expanse 1 inch.

Hab. Venezuela.

* *Thecla punctum* Herr.-Schäff. Samml. aus. Schmett. figs. 57–58.

† *Thecla mycon* G. & S., B. C.-A., Rhop. vol. ii. p. 46, pl. 53. figs. 20–22 (1887).

Type, Mus. Godman.

The type is the only specimen I have seen. It has a MS. name "*caninius* Moritz" attached to it and was formerly in the Kaden Collection.

THECLA PHARUS, sp. n. (Plate XXXIV. fig. 7.)

Male. Allied to *T. thyesta* Hew.; more robust and with both the brands larger. Dark opalescent bluish green, extending on the fore wing along the inner margin and reaching up to the cell. The hind wing has the costal margin, also the anal margin (except its pale edge) broadly and the outer margin very narrowly black. A small bright red spot at the anal angle. Under side: ground colour much darker and the linear bands straighter.

Expanse $1\frac{2}{5}$ inch.

Hab. Pará, Amazons (*Bates*).

Type, Mus. Godman.

THECLA RADIATIO, sp. n. (Plate XXXIV. fig. 8.)

Male. Allied to the preceding *T. pharus* and with two brands as in that species, but with the whole surface of both wings, excepting the discal area of the hind wing which is dark purple from the base to the outer margin, dark blackish brown. On the under side the ground-colour is dark brown, the linear band on the fore wing is almost invisible, whilst that on the hind wing shows clearly. The red spot at the anal angle is replaced by a black one, whilst that between the lower median nervules has become very indistinct.

Expanse $1\frac{2}{5}$ inch.

Hab. Pará, Amazons (*Bates*).

Type, Mus. Godman.

THECLA MUNDITIA, sp. n. (Plate XXXIV. figs. 10 ♂, 11 ♀.)

Male. Appearance of *T. thyesta* Hew.; smaller, with the blue areas of a slaty shade and in the fore wing confined to the inner margin. There is a very small brand at the end of the cell, and although the distinct black brand of *T. thyesta* appears to be wanting, a dull black patch may be discerned in its place on holding the insect up to a strong light. The lobe is small and black, and the tail, which is situated on the lower median nervule, appears to project at a right angle to the wing. The under side is clear pearly dark grey and the markings, which are distinctly defined, are much as in *T. thyesta*.

Female. Upper side uniform dark brown, with two black marginal spots between the nervules at the anal angle and a small black lobe. Under side as in male, but ground-colour paler.

Expanse ♂ ♀ 1 inch.

Hab. Bartica, British Guiana (*H. S. Parish*).

Types, Mus. Druce.

Not closely allied to *T. thyesta* Hew., and probably belonging to another group.

THECLA JACTATOR, sp. n. (Plate XXXIV. fig. 9.)

Male. Upper side: fore wing black, a jet-black, large, circular brand at the end of the cell, bright shining blue along the inner margin for about two-thirds its length from the base, and extending upwards to the lower wall of the cell. Hind wing bright shining blue, with the costal margin black. Under side pearly grey, with linear markings as in *T. thyesta*, and two red spots on hind wing as in that species.

Expanse $1\frac{1}{5}$ inch.

Hab. Paraguay (*Perrens*).

Type, Mus. Druce.

I have compared this insect with *T. thyesta* Hew., but besides having only one distinct brand the outer margin of the fore wing is very concave, consequently the apex is less acute. It is probably not closely allied and should, I think, be placed in a group by itself.

THECLA OCRISIA.

Thecla ocrisia Hew. Descr. of *Thecla*, p. 5 (1868); Ill. Diur. Lep., Lycænidæ, p. 122, pl. 48. figs. 236, 235 (1869).

Thecla peruviana Ersch. Trud. Russk. x. p. 57, pl. i. fig. 4 (1876).

Hab. Mexico to S. Paraguay.

THECLA ELSA.

Thecla elsa Hew. Ill. Diur. Lep. p. 198, pl. 79. figs. 639, 640 (1877).

Hab. Chiriqui.

Described from Staudinger's collection and not referred to by Messrs. Godman & Salvin in B. C.-A., who, however, describe and figure another ♀ from Chiriqui, also from Staudinger's collection, under the name *T. primno*, vol. ii. p. 47, pl. liii. figs. 25, 26 (1887).

I know these insects only from the descriptions and figures and can detect no differences.

THECLA BESIDIA.

Thecla besidia Hew. Descr. of *Thecla*, p. 24, ♀.

Male. Upper side: blue areas more extensive and shining and richer in intensity. A rather large, dark, pear-shaped brand situated at the end of and partly beyond the cell. Under side as in female, but ground-colour darker and red bands narrower.

Hab. Chapada Campo, Brazil (*H. H. Smith*). (♂ ♀ Mus. Godman.)

Hewitson's type is also in Mr. Godman's collection.

THECLA TORRIS, sp. n. (Plate XXXIV. fig. 16.)

Male. Allied to *T. besidia* Hew. Upper side: blue areas darker and less clearly defined and steely in shade. Under side: ground-colour pale greyish brown without the purple shading of *T. besidia*, with broad whitish outer marginal shading to both wings and with the transverse bands sepia-brown. The red spot containing the black dot between the lower median nervules on the hind wing is wanting.

Expanse $1\frac{1}{5}$ inch.

Hab. Rio Grande, Brazil.

Type, Mus. Druce.

THECLA OBELUS, sp. n. (Plate XXXIV. fig. 12.)

Male. Allied to *T. bagrada* Hew.*; brand at end of cell smaller and circular and without the additional brand which in *T. bagrada* rests on the base of the median nervules. Upper side dark shining blue, very brilliant when held at an angle, with the apical half of the fore wing and the costal margin of the hind wing dark brown. On the under side the ground-colour is darker and the red transverse bands are much as in *T. bagrada*, but that on the hind wing is more sinuous and continuous.

Female. Upper side brown; under side, ground-colour paler and red bands more inclined to break up into spots.

Expanse, ♂ $1\frac{3}{10}$, ♀ $1\frac{1}{10}$ inch.

Hab. Chapada Campo, Brazil (*H. H. Smith*).

Types, Mus. Godman.

Much like *T. bagrada* on the under side, but very different above.

THECLA LITERATUS, sp. n. (Plate XXXIV. figs. 13 ♂, 14 ♀.)

Male. Upper side: fore wing uniform dark brown, slightly dusted with greyish-blue scales along the inner margin towards the base; a small, distinct, pale, oval brand at the end of the cell. Hind wing brown, the anal half, from the base, shining opalescent cærulean blue. The abdominal fold broadly whitish. An anteciliary brown line, inwardly bordered with white towards the anal angle. An orange spot in the lobe which is thickly covered with whitish hairs. Cilia of fore wing brown, of hind wing whitish. On the under side the transverse bands and markings are arranged much as in *T. besidia* Hew., but are very much narrower and are outwardly bordered by clear white, whilst the ground-colour is very much paler and without the plumbeous tinge.

Female. Paler than the male, with the anal area of the hind wing on the upper side pale greyish blue, with scarcely any opalescence and with indistinct brown marginal spots between the nervules.

Expanse, ♂ ♀ $1\frac{1}{10}$ inch.

Hab. San José, Paraguay (*Perrens*).

Types, Mus. Druce.

This appears to be a common insect in Paraguay, Mr. Godman's collection containing a series of 15 specimens. We possess several specimens, and there are specimens in the Crowley Collection in the British Museum, probably derived from the same source.

* *Thecla bagrada* Hew. Descr. of *Thecla*, p. 22.

I have been unable to trace that it has been described, but it seems to be near to *Thecla nugar* Schaus, P. U.S. N. M. vol. xxiv. p. 408 (1902). Mr. Godman's collection contains a single male from Temax, N. Yucatan, which appears to agree with Mr. Schaus's description. *T. literatus* is much more strongly marked on the under side and the transverse band on the fore wing is much straighter. It is also a larger insect.

THECLA XOREMA.

Thecla xorema Schaus, P. U.S. Nat. Mus. vol. xxiv. p. 408 (1902).

Male. Allied to *T. obelus*, which it closely resembles on the upper side and is branded in the same position. On the under side the ground-colour is paler and the transverse bands are dark brown, and on the hind wing broken up into irregular spots, followed by a good deal of whitish shading. On the fore wing this band is notched inwardly at the upper radial, and beyond is a submarginal row of distinct dark lunules bordered with whitish and extending from the apex to the outer angle.

Female. Dark brown above, strongly suffused with blue towards the base of fore wing and over the disc of the hind wing. Under side as in male.

Expanse, ♂ ♀ $1\frac{1}{10}$ inch.

Hab. Rio Grande, and Castro, Parana, Brazil.

Type ♂, Mus. Druce.

Since the above description was written Mr. E. D. Jones has lent me a specimen of *T. xorema* Schaus, which agrees with one in our own collection from Rio Grande and which is a female. The specimen I have described with a brand is exactly like it on the under side, and there can be no doubt that Mr. Schaus was mistaken in considering his type to be a male, unless, indeed, he has omitted to mention the brand.

THECLA CAUTER, sp. n. (Plate XXXIV. fig. 15 ♂.)

Male. Upper side much like *T. obelus*, blue areas more slaty, outer margin of hind wing more broadly brown and red anal spot large and prominent. Under side uniform clear brown. Fore wing: an ultramedian central band composed of five confluent red lunules, outwardly bordered with pure white, the two lower lunules being detached and placed further inwards; beyond this band is a submarginal row of bright red lunules faintly bordered inwardly with blackish. A dark anteciliary line. Hind wing: an ultramedian much-broken band, commencing on the costa and reaching to the abdominal margin, consisting of large bright red patches, bordered inwardly and outwardly with black and again with clear white. A large red patch above the lobe which is black, and a broad red marginal band, inwardly edged with black, commencing at the apex and gradually widening to the lower median nervule, where it contains a black dot on the margin.

A dark anteciliary line. Cilia of both wings brownish, paler at the tips.

Female. Upper side dark brown, the lobe orange-red and prominent. Under side as in ♂.

Expanse, ♂ ♀ $1\frac{1}{5}$ inch.

Hab. Chapada Campo, Brazil (*H. H. Smith*), September–November.

Types, Mus. Godman.

Mr. Smith obtained a good series. Mr. Godman's collection contains a worn female which certainly belongs to this species, from Roraima, British Guiana (*Whitely*).

Mr. E. D. Jones has examples captured by himself at Castro, Parana.

THECLA TIASA.

Thecla tiasa Hew. Ill. Diur. Lep., Lycæn. p. 122, pl. 48. figs. 229, 230.

Stated by Hewitson to be in his own collection, but is not now there, neither is it referred to by Mr. Kirby in his Catalogue of the Hewitson Collection. Mr. Godman's collection contains a single ♀, formerly in the Kaden Collection, but without locality, to which is affixed a label in Hewitson's handwriting "*tiasa* Hew.," probably this is the type. It agrees well with the figure. Mr. Godman also possesses a ♂ which was formerly in Bates' collection labelled "*tiasa*," which is referred to in B. C.-A. ii. p. 52, in describing *Thecla ortalus*.

THECLA ENDERA.

Thecla endera Hew. Ill. Diur. Lep., Lycæn. p. 111, pl. 42. figs 156, 157, ♂.

Thecla thestia Hew. Ill. Diur. Lep., Lycæn. p. 122, pl. 48. figs. 231, 232, ♀.

Hewitson described the ♂ from the British Museum collection and the ♀ from his own collection, and an examination of the two types convinces me that they are the two sexes of one species.

The orange anal spot on upper side of hind wing varies considerably, some specimens of both sexes in Mr. Godman's collection being without it.

THECLA BURIS, sp. n. (Plate XXXIV. fig. 18.)

Male. Much like *T. genena* Hew.*, but with the shining greenish-purple areas of that species replaced by bright green, and with an additional small black brand placed within and at the end of the cell, on the fore wing above. Under side as in *T. genena*.

Female. Upper side brown, with an orange spot on the lobe; underside as in male but paler, and red areas on hind wing more extensive.

* *Thecla genena* Hew. Ill. Diur. Lep. p. 111, pl. 44. figs. 185, 186.

Expanse $1\frac{2}{5}$ inch.

Hab. Ega, Amazons (*Bates*).

Types, Mus. Godman.

The additional brand on the fore wing serves to distinguish this insect at once from *T. genena*; it also appears to be allied to *T. illex* Schaus, P. U.S. N. M. vol. xxiv. p. 419 (1902), from Colombia. Hewitson's type is now in Mr. Godman's collection.

THECLA CALTHA, sp. n. (Plate XXXIV. fig. 19.)

Male. Upper side dark brown, the basal and discal areas thinly suffused with shining purple-blue. An oblique ovular sac-like brand occupying most of the cell of the fore wing, but not distinctly apparent, with a longitudinal opening and enclosing large whitish scales. Under side much like that of *T. stagira* Hew.*, but the ultramedian line on the hind wing more sinuous and the red anal areas more developed, especially over the lobe. The lobe is very small and on its upper side contains a faint red spot.

Female. Upper side uniform dark brown, an orange spot at anal angle; under side as in male, but paler.

Expanse, ♂ $1\frac{3}{10}$, ♀ $1\frac{3}{5}$ inch.

Hab. Santarem, Amazons.

Types, Mus. Druce.

Mr. Godman's collection also contains a specimen (♂) formerly in Bates's cabinet, but the locality is not specified.

The character of the brand is unusual and the cell of the fore wing is very short and narrow, and probably when these insects can be properly classified a new genus will have to be created for them.

THECLA LEUCOPHÆUS.

Bithys leucophæus Hübn. Zutr. Exot. Schmett. figs. 87, 88, ♂.

Thecla halala Hew. Descr. of Lycænidæ, p. 7 (1868); Ill. Diur. Lep. p. 175, pl. 69. figs. 508, 509, ♀.

Siderus parvinotus Kaye, Trans. Ent. Soc. 1904, p. 195.

Mr. Grose Smith has kindly lent me Hewitson's type of *T. halala*, which was formerly in the Saunders Collection, and I have no doubt that it is the female of Hübner's insect. Hewitson originally described it as a male, but when figuring it later (1874) described it as a female.

I have found one other example in Mr. Godman's collection from Para, which is probably the specimen referred to by Hewitson as being in Bates's cabinet.

T. leucophæus Hübn., male, is common, but the female appears to be rare.

Mr. Kaye has kindly lent me his type from Trinidad, which does not differ in any way from Venezuelan specimens from the

* *Thecla stagira* Hew. (=*T. spurina* Hew.) Ill. Diur. Lep. p. 102, pl. 39. figs. 122, 123. For synonymy of *T. spurina* Hew., see Ann. Mag. Nat. Hist. ser. 7, vol. xv. (1905) pp. 194, 195.

Kaden Collection now in Mr. Godman's possession. It is evident from Mr. Kaye's description of his species that he has wrongly identified *T. dindymus* Cr., as he writes of the "shape of the band" (=brand). The *Papilio dindymus* Cr. is an insect without any brand and is well known.

THECLA NOTA, sp. n. (Plate XXXIV. fig. 17.)

Male. Allied to *T. doryasa* Hew.* and, like that species, with a large black brand in the cell and a smaller pale brand beyond. The under side differs in the ground-colour being pale straw-colour, with the ultramedian linear bands narrow and faint and in the hind wing less sinuous, in the absence of the marginal shades on both wings, and in the almost entire disappearance of the red blotches on the hind wing towards the anal angle.

Expanse 1 inch.

Hab. San Sebastian, Colombia (*F. Simons*).

Type, Mus. Godman.

The type-specimen is somewhat rubbed on the upper side, but on the under side it presents a very different appearance to that of *T. doryasa.*

THECLA PURPURA, sp. n. (Plate XXXIV. fig. 20.)

Male. Upper side: appearance of *T. leucophæus* Hübn.; darker and with broader black outer marginal borders. The double brand smaller and inclined to separate. Anal fold dark grey. Under side pearl-grey, without the white irroration which is conspicuous in *T. leucophæus*; fore wing unmarked; hind wing with the ultramedian linear band narrower and more inclined to break up into spots. Red spot at anal angle minute.

Expanse $1\frac{2}{5}$ inch.

Hab. Espiritu Santo, Brazil.

Type, Mus. Druce.

Two specimens not showing any variation. It is also allied to *T. hostis* Schaus, P. U.S. N. M. vol. xxiv. p. 420 (1902), which I should consider more nearly allied to *T. leucophæus* Hübn. than to *T. tephræus* Hübn. The brand, however, is not in two distinct divisions as in that species and is much smaller.

THECLA NIVEPUNCTATA, sp. n. (Plate XXXV. fig. 1 ♂.)

Male. Upper side shining indigo-blue; apex rather broadly and costa narrowly dark brown. A single, paler, pear-shaped brand at the end of the cell. A few red scales on the lobe; anal fold pale grey. Cilia of fore wing brown, of hind wing whitish towards anal angle. Under side rich chocolate-brown; fore wing broadly pale grey along the inner margin; an ultramedian band, commencing just below the costa and ending at the lower median nervule, composed of pure white lunules, inwardly bordered with dark brown, the two lower lunules being placed further out from

* *Thecla doryasa* Hew. Ill. Diur. Lep. p. 179, pl. 70. figs. 527, 528.

the line; beyond is a submarginal row of dark lunules, inwardly and outwardly bordered with pale brown. Hind wing: two distinct white spots near the base, one placed near the costal margin, the other below it towards the centre of the wing; beyond these spots is a much-broken white macular band, broadest on the costa and becoming linear on the anal margin. An irregular series of pale lunules and a darker brown apical patch. A fine whitish marginal line from the apex to the anal angle, followed by a black anteciliary line. A black red-crowned dot between the lower median nervules placed some distance from the margin. Lobe black, partially crowned with white. A patch of bluish-grey scales on the margin between the lobe and the lower tail. Abdomen bluish above; pale yellow below.

Female. Upper side as male, but duller; under side as in male.

Expanse, ♂ $1\frac{1}{10}$–$1\frac{3}{10}$ inch, ♀ $\frac{9}{10}$ inch.

Hab. British Guiana, Surinam.

Types, Mus. Druce.

This is a well-marked species on the under side, but I am unable to trace that it has been described. It is not nearly allied to any with which I am acquainted.

THECLA PORPHYRETICUS, sp. n. (Plate XXXV. fig. 2.)

Male. Upper side: brilliant shining ultramarine-blue; costa, apex and outer margins broadly and clearly black. A moderate-sized oval brand at the end of the cell of fore wing. Under side rich plumbeous brown, paler along inner margin of fore wing and anal margin of hind wing. Fore wing without markings but bright red at the extreme base of the costa. Hind wing with a large oval white spot below the costal margin placed about half-way between the base and a large white patch which is situated on the margin above the apex. A discular band composed of separated white spots and becoming linear and broader towards the anal margin. Whitish scales dusted over the anal area. Lobe black, small.

Expanse $1\frac{2}{5}$ inch.

Hab. Rio Napo, Peru (*Whitely*).

Type, Mus. Godman.

A very distinct insect, not nearly allied to any described form.

THECLA CIMELIUM.

Thecla cimelium Gosse, Entomologist, vol. xiii. p. 203, pl. 2. fig. 2 (1880).

Hab. Paraguay (*Perrens*); Rio de Janeiro (*H. H. Smith*), Mus. Godman. Castro, Parana (*E. D. Jones*).

As pointed out by Gosse in his description, this insect is very different from *T. syncellus* Cr. on the under side, but no mention is made of its close relationship (if indeed it is distinct) to *T. hebræus* Hew.* On the upper side I can find no points of

* *Thecla hebræus* Hew. Ill. Diur. Lep. p. 104, pl. 43. figs. 165, 166.

distinction from that species, but on the under side the markings are less clearly defined and the whole surface is more clouded in both sexes. Mr. Godman has male and female *T. hebræus* which were formerly in the Kaden Collection, there is a male in the British Museum, and we have a female from Espiritu Santo, Brazil.

Mr. E. D. Jones has shown me two males captured by himself which are referable to *T. cimelium*. Gosse's types are in the British Museum. Hewitson's type was in Boisduval's collection.

THECLA PAPHLAGON.

Pseudolycæna paphlagon Feld. Reise Nov., Lep. p. 249, pl. 31. figs. 10, 11 (1865).

Male. Upper side bright shining blue of a greener shade than *T. ochus* G. & S.* and with the black area of the fore wing reduced to a small patch beyond the brand at the end of the cell. The conspicuous black hairs along the submedian nervure of the hind wing are also absent. Under side as in female but darker.

Hab. Cucuta, Venezuela. Mus. Druce.

As surmised by Messrs. Godman & Salvin in B. C.-A., there is no doubt that Felder described the female as the male.

It is a rare insect, the male described above being the only example of its sex that I have seen.

THECLA PANCHÆA.

Thecla panchæa Hew. Ill. Diur. Lep. p. 126, pl. 51. figs. 274, 275.

Thecla scoteia Hew. Ill. Diur. Lep. p. 206, pl. 82. figs. 683, 684.

Hab. Cucuta, Venezuela. Mus. Druce.

Mr. Grose Smith has kindly lent me his type of *T. scoteia*, which is without doubt the male of the previously described *T. panchæa*. They are identical on the under side.

T. pion, G. & S. B. C.-A., Lep. Rhop. vol. ii. p. 56, pl. 54. figs. 28–30 (1887), is very close to this species, if indeed it is distinct. It is perhaps rather less greenish in tint and the female is darker.

THECLA CŒLEBS.

T. cœlebs Herr.-Schäff. Corresp.-Blatt. Regensb. xvi. p. 142 (1862); Hew. Ill. Diur. Lep. p. 156, pl. 62. figs. 416, 417 (1874).

T. fidena Hew. l. c. pl. 44. figs. 183, 184 (1867).

An examination of Hewitson's type of *T. fidena*, which is a male and was described from an unknown locality, has convinced me that it is the male of Herrich-Schäffer's species, of which we have several examples from Cuba obtained by Parish. *T. cœlebs* is allied to *T. panchæa* Hew., *T. pion*, G. & S., and *T. piplea* G. & S., and like those insects has the tuft of hairs near the base of the

* *Thecla ochus* G. & S., B. C.-A., Lep. Rhop. vol. ii. p. 55, pl. 54. figs. 24–27 (1887).

subcostal nervure on the upper side of hind wing. Mr. Godman has two females from Haiti, which have lost the greenish tinge on the ground-colour below, but this may be due to their being somewhat faded.

THECLA DELICIÆ, sp. n. (Plate XXXV. fig. 3.)

Male. Closely allied to *T. cyllarus* Cr. *, from which it differs on the under side in the entire absence of the narrow black zigzag lines and shades. Both the red patches at the anal angle are large and prominent and are connected by a narrow red line. The patch of scales on the under side of the fore wing is large, blackish, and prominent as in *T. cyllarus.*

Expanse $1\frac{4}{5}$ inch.

Hab. Maranham, N. Brazil.

Type, Mus. Godman.

This insect may prove to be an aberration of *T. cyllarus* Cr., but amongst a large series of that species I am unable to discover anything approaching it. It has a very distinct appearance.

THECLA PORPHYRITIS, sp. n. (Plate XXXV. fig. 4.)

Male. Allied to *T. cyllarus* Cr., from which it differs on the under side in the ground-colour being much darker and the white markings more prominent and in the glandular patch on the fore wing being quite small, nut-brown, and close to the base; the inner margin being broadly pale and the discal portion of the wing above the submedian nervure having a silky appearance.

Female. Both surfaces slightly paler than male, but the area of blue on the upper surface is scarcely less.

Expanse $1\frac{3}{5}$ inch.

Hab. Tapajos and Pará, Brazil.

Types, Mus. Godman.

Mr. Godman's collection contains male and female from Para and male from Tapajos from Bates's collection, which were unidentified by him, and male from Para captured by H. H. Smith.

THECLA TYRIAM, sp. n. (Plate XXXV. fig. 5.)

Male. Allied to *Thecla perola* Hew.†, having the same broad silky costal margin to hind wing above, but with the blue area along the inner margin of the fore wing less extensive and not reaching nearly to the outer angle. On the under side the ground-colour is much paler, and the large black glandular patch on the fore wing of *T. perola* is replaced by a smaller, pale straw-colour patch, paler than the ground-colour of the wings.

Expanse $1\frac{1}{2}$–$1\frac{7}{10}$ inch.

Hab. Pará, Brazil (*H. H. Smith*).

Type, Mus. Godman.

* *Papilio cyllarus* Cr. Pap. Exot. i. pl. 27. C, D (1775).

† *Thecla perola* Hew. Ill. Diur. Lep.pl. 46. figs. 211, 212 (1867).

There are specimens in the British Museum from San Paulo, Para, and Tapajos which were separated from *T. cyllarus* by Dr. Butler, and I have found a male in the Hope Museum at Oxford labelled "S. America, presented by G. C. Griffiths."

Hewitson's description and figure of the under side of *T. perola* are somewhat inadequate. He writes of the underside (p. 112) "Anterior wing dark brown where the wings meet." In reality there is a large black oval glandular patch which does not extend more than half-way down from the median to the submedian nervure.

The type male is now in Mr. Godman's collection.

THECLA TREBONIA.

Thecla trebonia Hew. Equat. Lep. p. 63 (1870); Ill. Diur. Lep. p. 162, pl. 64. figs. 443, 444.

Mr. Grose Smith has several specimens from Ecuador in which the blue is of a more purplish hue and more extensive on the fore wing and surrounding, except along the costal side, the large black patch of androconia which is placed beyond the end of the cell, thereby giving the insect a different appearance. On the under side of the fore wing the ultramedian band is more irregular than in typical specimens.

THECLA UTERKUDANTE, sp. n. (Plate XXXV. fig. 9.)

Male. Allied to *T. trebonia* Hew., from which it differs on the upper side in being of a brilliant rich dark blue and in the absence of the conspicuous paler patch at the end of the cell. On the under side the glandular patch on the fore wing is straw-colour in place of blackish, and the interior black and white band is rather broader and commences near the costa in a large triangular white spot.

Expanse $1\frac{4}{5}$ inch.

Hab. Interior of Colombia (*J. Carder*).

Type, Mus. Druce.

Mr. Godman's collection also contains a specimen from the Rio Minero, Muzo, Colombia, 2500 feet, obtained by Wheeler.

THECLA OSTRINUS, sp. n. (Plate XXXV. fig. 6.)

Male. Closely allied to *T. cyllarus* Cr. Differs on the upper side in the outer margin of the hind wing being very narrowly black, in the lobe being very small and blue like the disc of the wing, and in the anal fold being wholly blue. On the under side the ground-colour has a decidedly greenish tinge and the large glandular patch, which is so conspicuous in *T. cyllarus*, is entirely absent.

Expanse $\frac{7}{10}$ inch.

Hab. Cayenne.

Type, Mus. Godman.

Easily distinguished by the absence of the glandular patch below.

THECLA PURPURANTES, sp. n. (Plate XXXV. fig. 7.)

Male. Allied to *T. foyi* Schaus*, from which it differs on the upper side in the blue being of a greener shade and the lobe black, not orange as in that species. On the under side the black and white linear band on the hind wing is more angulated and more distinct. On the fore wing the glandular patch is silky, opalescent, straw-colour, darker towards its centre.

Expanse $1\frac{3}{5}$ inch.

Hab. Peru.

Type, Mus. Druce.

There is also a specimen in the British Museum from the Crowley Bequest.

Specimens of *T. foyi* have been placed in the British Museum by Mr. Schaus, with which I have compared those now before me.

THECLA PHOSTER, sp. n. (Plate XXXV. fig. 8.)

Male. Allied to *T. ostrinus* and *T. cyllarus*, from which latter it is not distinguishable on the upper side, having the red spot in the lobe. On the under side the ground-colour is much darker and more shiny. The glandular patch is larger and of much the same shade as the wings, whilst the silky scales surrounding it are much rougher in appearance and are more extensive. On the hind wing the submedian band is very prominent and more inclined to be broken up into separate spots.

Expanse $1\frac{7}{10}$ inch.

Hab. Surinam.

Type, Mus. Druce.

THECLA PULCHRITUDO, sp. n. (Plate XXXV. fig. 11.)

Male. Allied to *T. ericeta* Hew.† Upper side shining violaceous blue, extending well beyond the cell in the fore wing. Hind wing with the dark silky patch along the costal margin much reduced. Under side: ground-colour uniform dark pearly grey, inner margin of fore wing broadly paler. Fore wing: a large darker glandular patch below the cell which is wholly pale opalescent blue; an ultramedian whitish linear band, from near the costa to the lower median nervule, and some submarginal whitish shades which become more prominent towards the outer angle. Hind wing with an ultramedian whitish linear band commencing on the costal nervure much nearer to the apex than in *T. ericeta*. The red anal spots are almost obsolete. Abdomen blue above; pale below.

Expanse $1\frac{3}{5}$ inch.

Hab. Amazons.

Type, Mus. Druce.

The position of the bands on the under side, together with the opalescent blue cellular area to the fore wing serve to distinguish

* *Thecla foyi* Schaus, P. U.S. N. M. vol. xxiv. p. 417 (1902).

† *Thecla ericeta* Hew. Ill. Diur. Lep. p. 104, pl. 44. figs. 177, 178.

this insect at once. The outer margins of both wings appear more convex than in *T. ericeta*.

THECLA MULSUS, sp. n. (Plate XXXV. fig. 10.)

Male. Allied to *T. elana* Hew.*, but differs in the upper side being more purple in colour, and on the under side in the fore wing being unmarked and the hind wing lacking the white spots on the costal margin.

Female. Upper side pale brown; inner margin of fore wing and discal and basal areas of hind wing pale shining blue. Under side as in male.

One long black tail in both sexes, tipped with white.

Expanse $1\frac{2}{5}$ inch.

Hab. Tapajos, Amazons (*Bates*).

Types, Mus. Godman.

Also much like *T. gadira* Hew.† on upper side, but has a tail.

THECLA LEVIS, sp. n. (Plate XXXV. fig. 14.)

Male. Upper side rich dark blue; costa of fore wing broadly black at the base; apex and outer margins broadly black, abdominal margin cream. A small black brand at the end of the cell. Under side: ground-colour rich cream, fore wing with basal and discal area pale brown sharply defined at its outer edge. A submarginal row of indistinct brownish lunules. Hind wing: a broad, median, irregular brown band, commencing on the costal nervure, becoming broadest towards the centre of the disc, where it is angulated and becomes linear to the middle of the anal margin. A submarginal row of small distinct lunules. A bright red spot at the anal angle and a smaller one between the lower median nervules adjoining the brown lunule.

Abdomen black above; cream below. Hind wing without tails.

Expanse $1\frac{2}{5}$ inch.

Hab. Pará, Amazons.

Type, British Museum.

Not closely allied to any species described, but may prove to belong to the group which contains *T. gadira* Hew.†, although it has a smaller and circular brand.

THECLA CONCHYLIUM, sp. n. (Plate XXXV. fig. 12.)

Male. Allied to *T. norax* G. & S.‡ Upper side: outer margins more narrowly black, especially on the hind wing; brand on fore wing much smaller, paler, and indistinct. On the under side the red dot between the lower median nervules of the hind wing is absent, whilst that at the anal angle is very minute.

Female. Upper side dark brown; inner margin of fore wing and discal areas of hind wing shining blue. Under side as in male, but with red marginal spot on hind wing as in *T. gadira* Hew.†

* *Thecla elana* Hew. Ill. Diur. Lep. p. 170, pl. 67. figs. 482, 483.

† *Thecla gadira* Hew. Ill. Diur. Lep. p. 113. pl. 44. figs. 181, 182.

‡ *Thecla norax* G. & S., B. C.-A., Rhop. vol. ii. p. 59, pl. 55. figs. 17, 18 (1887).

Expanse $1\frac{1}{5}$ inch.

Hab. Rio Grande, Chapada Campo, Brazil (*H. H. Smith*). Castro, Parana (*E. D. Jones*). Paraguay (*B.M.*).

Type, Mus. Druce.

Mr. Jones has shown me several specimens captured by himself. It is also allied to *T. gadira* Hew.

THECLA ATTALION.

Thecla attalion Godm. & Salv. B. C.-A., Lep. Rhop. ii. p. 60, pl. 55. figs. 19, 20 (1887).

This will probably prove to be the male of Hewitson's *T. quaderna* *, which again does not appear to differ from the previously described *T. læta* † Edwards. Very few examples of this group, for which the generic name *Erora* has been proposed by Scudder, are to be found in collections, and before sinking any of these names it is advisable to await the arrival of more specimens.

THECLA SMARAGDUS, sp. n. (Plate XXXV. fig. 13.)

Male. Upper side: dull violaceous brown. Cilia brown, outwardly whitish. Under side pale emerald-green; fore wing with a fine white line from the costa to the lower median nervule; hind wing with a much broken fine white line from the costal to inner margin, where it is inwardly bordered with a faint black streak. A small red patch at the anal angle. Cilia of both wings black outwardly edged with white.

Expanse $\frac{9}{10}$ inch.

Hab. Chapada, Brazil (*H. H. Smith*). Castro, Parana (*E. D. Jones*).

Type, Mus. Godman.

Allied to *T. biblia* Hew. and *T. ares* G. & S., but at once distinguished by the black cilia below.

Mr. E. Dukinfield Jones's collection contains a specimen of this species.

THECLA SESARA.

Thecla sesara Godm. & Salv. B. C.-A., Lep. Rhop. ii. p. 722, pl. 111. figs. 7, 8 (1901).

Type, Mus. Schaus.

The name "*sesara*" has been previously given to a species belonging to another group of *Thecla* (B. C.-A. p. 90), but as both may eventually be placed in different genera, I refrain from suggesting another name.

THECLA SELINA.

Thecla selina Hew. Ill. Diur. Lep., Lyc. p. 118. pl. 50. fig. 255, ♀.

Hewitson separated this insect from *T. pholeus* Cr. principally

* *Thecla quaderna* Hew. Descr. Lycæn. p. 35 (1868).

† *Thecla læta* Edwards, P. Ac. Nat. Sc. Phil. 1862, p. 56.

owing to the different appearance of the female on the under side. There is, however, in Mr. Godman's collection a female from Obydos, Amazons, which is identical with the form found in Guiana and figured by Stoll.

I have examined a considerable number of males from Surinam and Cayenne, and find that they always have three or four separated blue spots on the hind wing below as shown in Cramer's figure, pl. 163. E. These spots are always absent in specimens from Colombia, Brazil, and the Amazon regions.

There is a small race of males of both forms as regards the under side, in which the blue of the upper surface has almost entirely disappeared, leaving the wings brown like the female. We have several such specimens from Surinam, whence there is also one in the British Museum, whilst Mr. Godman has some from Tapajos and Ega.

THECLA COLLUSTRA, sp. n. (Plate XXXV. fig. 15.)

Male. Upper side uniform dark grey with purple reflections. Abdominal half of hind wing dull indigo-blue which, when held at an angle, appears shining. Lobe small, with a central orange spot almost surrounded by white. Cilia and abdominal fold pale grey. Under side: ground-colour pale grey. Fore wing: an ultramedian linear white band inwardly bordered with yellow and a submarginal dark line. Hind wing: an ultramedian, linear, white line commencing on the costa and reaching, much-angled, to the anal margin, inwardly bordered with a black line and again with a bright yellow line. A large orange marginal patch occupying the space between the lower median nervules and beyond, paler inwardly and supporting on its outer edge a small, distinct, triangular black spot. Lobe black, crowned with white and again by an elongate orange patch. Space between the lobe and tail dusted with black and white scales. An anteciliary black line inwardly bordered with white. Cilia of fore wing brownish, of hind wing grey. Tails black tipped with white. Abdomen dark above, pale below.

Expanse 1 inch.

Hab. Caparo, W. Cent. Trinidad (*F. Birch*).

Type, Mus. Druce.

On the under side this insect is much like *T. lemuria* Hew.*, but on the upper side is quite different The outer margin of the fore wing is somewhat convex, and I had thought that it might be the female of that species, which is undescribed. But a close examination has convinced me that I had before me the male of another species which does not appear to be described. The terminal joint of the palpi is comparatively short as is usual in males.

Mr. Godman has two males of *T. lemuria*, including the type.

* *Thecla lemuria* Hew. Descr. of *Thecla*, p. 10.

THECLA PURPURITICUS, sp. n. (Plate XXXVI. fig. 2.)

Male. Allied to *T. empusa* Hew.*, which it closely resembles on the upper side. On the under side the ground-colour is darker; the red crown to the black marginal spot between the lower median nervules on the hind wing is entirely absent and the orange area is much more extensive, the submarginal shades being placed further in and close to the linear band.

Female. Differs only from the male in the black area on the upper side being slightly duller.

Expanse $1\frac{2}{5}$ inch.

Hab. Interior of Colombia (*J. Carder*).

Types, Mus. Druce.

There is also a male in the British Museum from Bogota.

THECLA GENTIANA, sp. n. (Plate XXXVI. fig. 1.)

Male. Much like *T. tarena* Hew.†, but fore wing above with a large, distinct, deep black oval patch, occupying the outer half of the cell and inwardly bordered by a dark grey patch of differently placed scales, the blue area being reduced to the extreme base. Under side: ground-colour pale brown with sordid white linear bands as in *T. tarena*, but straighter and less prominent, and the red spot between the lower median nervules placed nearer to the margin.

Expanse $1\frac{3}{10}$ inch.

Hab. Bogota, Colombia.

Type, Mus. Druce.

Although this insect is much like *T. tarena* Hew. and *T. empusa* Hew. at first sight, a closer examination shows it to be quite distinct, and it may eventually prove to be not very nearly allied.

Messrs. Godman & Salvin have given the synonymy of *T. empusa* in B. C.-A., Rhop. ii. p. 61.

THECLA PHILINNA.

Thecla philinna Hew. Descr. of *Thecla*, p. 19 (1868); Ill. Diur. Lep. p. 138, pl. 55. figs. 334, 335 (1873).

Tmolus unilinea Kaye, Trans. Ent. Soc. 1904, p. 192.

This is a variable species on the under side, some specimens having the ground-colour almost pure white, whilst the spots on some are rich dark brown and on others vary to golden yellow, in some specimens very prominent and in others much reduced in size and intensity. I have examined Mr. Kaye's type in the British Museum, and feel certain that it is only an extreme form.

Mr. Godman's collection contains a good series from Mexico (Atoyac, Vera Cruz, May, *H. H. S.*) to S.E. Brazil, including one female from Panama (Calobre, *Arcé*) marked on the under side like Mr. Kaye's type.

* *Thecla empusa* Hew. Ill. Diur. Lep. p. 106, pl. 42. figs. 158, 159.

† *Thecla tarena* Hew. Ill. Diur. Lep. p. 176, pl. 69. figs. 515, 516.

No two specimens are identical, but the northern specimens are usually, although not invariably, whitish on the under side.

This species is not included in the Biologia Centr.-Amer., as Mr. Smith's captures were doubtless received after the *Theclas* were completed, and the only example from Panama is a female.

THECLA VENUSTUS, sp. n. (Plate XXXVI. figs. 3 ♂, 4 ♀.)

Male. Allied to *T. echion* Linn. (*crolus* Cr.). Upper side shining violaceous blue; costa and apical half of fore wing dark brown; a darker patch at the end of the cell. Hind wing: inner margin narrowly brown, a fine anteciliary black line, inwardly bordered by a white line towards the anal angle. Lobe black, with some orange scales. Cilia of fore wing bright cupreous, of hind wing brown at the apex, whitish towards the anal angle. Under side: bands and spots arranged as in *T. echion*, but faintly outlined with black although clearly bordered with white. The ultra-median band on the fore wing is straighter and the ground-colour is darker than usually obtains in *T. echion*.

Female. Upper side: fore wing pale brown, greyish at the base, a large darker patch beyond end of the cell. Hind wing pale grey, darker towards the base, slightly opalescent; inner margin broadly pale brown. A marginal row of dark brown spots from the apex to the anal angle where they become largest, placed between the nervules. An anteciliary black line. Tails black, bordered and tipped with white. Cilia of fore wing reddish brown, of hind wing pale grey. Under side as in male, but ground-colour paler.

Expanse, ♂ $1\frac{1}{5}$, ♀ $1\frac{1}{10}$ inch.

Hab. Chapada Campo, Brazil (*H. H. Smith*).

Types, Mus. Godman.

Mr. Godman's collection contains six specimens which show no variation. The violaceous blue and the bright-coloured cilia should easily distinguish this insect from its allies. The specimens were captured in November and December.

THECLA LABES, sp. n. (Plate XXXVI. fig. 6.)

Male. Upper side dull olivaceous brown; a large black patch occupying the whole of the cell of the fore wing; abdominal half of hind wing suffused with greenish-blue scales when held at an angle; abdominal margin brown. Cilia of fore wing brown, of hind wing paler. Underside markings as in *T. echion* L.

Expanse $\frac{9}{10}$ inch.

Hab. Cunapo, Trinidad (*F. Birch*).

Type, Mus. Druce.

At one time it appeared that this insect might be a diminutive example of *T. echion*, which it closely resembles on the under side, but the upper surface is so different that I think it requires a name.

Mr. Birch captured it on 21st June.

THECLA LENITAS, sp. n. (Plate XXXVI. fig. 5.)

Male. Upper side: fore wing uniform dull brown, paler towards centre of disc, inner margin very narrowly dusted with blue. Hind wing pale violaceous blue, with the costa, apex, and outer margin rather broadly brown; abdominal fold paler brown. Cilia of fore wing brownish, of hind wing white. Underside: ground-colour uniform pale grey. Fore wing: a linear dark ultramedian band, outwardly bordered with white, from the costa to the lower median nervule, followed by a faint submarginal lunular line. A very fine anteciliary dark line. Cilia yellowish grey, darker at the tips. Hind wing: a median linear band as on fore wing but more sinuous, commencing on the costa and reaching to the abdominal margin, followed by a submarginal faint lunular line which becomes more distinct towards the anal angle. A black anteciliary line from the apex to the anal angle broadest at the base of the tails. Cilia pale grey. Tails blackish, tipped with white.

Female. Upper side uniform dull brown. Under side as in male.

Expanse ♂ ♀ 1–1$\frac{1}{5}$ inch.

Hab. Chapada Campo, Brazil (*H. H. Smith*); Paraguay (*Perrens*). Mus. Druce.

Types, Mus. Godman.

A species with no brand or perceptible patch on the fore wing and not allied to any with which I am acquainted, but perhaps belonging to the group which contains *T. dindymus* Cr.

Mr. Smith's specimens were captured in January and February.

THECLA STILBIA.

Thecla stilbia Hew. Ill. Diur. Lep., Lyc. p. 107, pl. 39. fig. 127, ♂.

This species is very near to *T. dindymus* Cr., but can be distinguished by the ultramedian linear band, which is common to both wings on the under side, being composed of crescent-shaped markings, and by possessing an extra dot on the costa placed away towards the apex. We have several specimens from Espiritu Santo, Brazil, agreeing with the type in the British Museum. Mr. Godman also has a specimen from the same locality. Hewitson does not state whence he received his type.

THECLA ORCYNIA.

Thecla orcynia Hew. Descr. Lyc. p. 11; Ill. Diur. Lep. p. 121, pl. 50. figs. 262–265.

Thecla anthracia Hew. Ill. Diur. Lep. p. 166, pl. 65. figs. 461–3, must be added to the synonymy of this species, the types from Brazil not differing in any important details from those from Guatemala and (*T. anina*) from Venezuela.

THECLA AHOLA.

Thecla ahola Hew. Ill. Diur. Lep. p. 82, pl. 35. figs. 73, 74, ♂ (1867).

Thecla cordelia Hew. Equat. Lep. p. 64 (1870); Ill. Diur. Lep. p. 165, pl. 65. figs. 453, 454, ♀.

Hewitson described the male from Mexico and New Granada and the female from Ecuador. Mr. Godman has two males from Venezuela, whence we also have specimens, labelled Cucuta; we have also a female from the interior of Colombia which is identical with Hewitson's type of *T. cordelia.* His figures of both sexes are very indifferent.

THECLA MARMORIS, sp. n.

♂. Allied to *T. ahola* Hew.*, which it closely resembles on the upper side, but differing on the under side in possessing a double white bar at the end of the cell of the fore wing, and in the white median line being strongly sinuous as on the hind wing, and the submarginal grey band being composed of circular in place of crescent-shaped lunules.

Expanse $1\frac{3}{10}$ inch.

Hab. Colombia.

Type, British Museum.

THECLA GABATHA.

Thecla gabatha Hew. Equat. Lep. p. 62; Ill. Diur. Lep. p. 174, pl. 68. figs. 504, 505.

Thecla balius Godm. & Salv. B. C.-A., Rhop. ii. p. 65, pl. 56. figs. 6, 7, ♂ (1887).

An examination of the types of the two species described under these names shows that they cannot be separated.

In addition to the localities already quoted for this insect I can add Belize, British Honduras (*Sir A. Moloney*), Mus. Druce.

THECLA CANITUS, sp. n. (Plate XXXVI. fig. 8.)

Male. Upper side: fore wing dark brown; inner margin dusted with pale blue scales towards the base, a large black patch occupying the outer half of the cell. Hind wing pale violaceous blue, the costal half dark brown; a dark brown anteciliary line from below the apex to the anal angle inwardly whitish. A dark marginal spot between the lower median nervules followed by another near the lobe, which is, however, absent in some specimens. Lobe orange. Cilia of fore wing brownish, of hind wing white.

Under side: ground-colour pale brownish grey with whitish marginal shades and rich brown spots and bands inwardly and outwardly bordered with dark brown and again with white. Fore wing: a mark at the end of the cell composed of two confluent spots one above the other; beyond this, commencing on the costa halfway to the apex and reaching to the lower median nervule, a band composed of six confluent spots, the two lower spots being placed further inwards. Hind wing: several basal spots, a double linear streak at the end of the cell followed by a much broken band from the costa to the abdominal margin; a triangular

* *Thecla ahola* Hew. Ill. Diur. Lep. p. 82, pl. 35. figs. 73, 74 (1867).

black marginal spot crowned with orange, placed between the lower median nervules. Lobe black, crowned with orange. A dark anteciliary line common to both wings. Cilia of fore wing brownish, of hind wing white.

Female. Upper side: fore wing uniform brown. Hind wing as in male, blue area slightly less extensive basally and rather paler. Under side as in male.

Expanse, ♂ $1\frac{1}{10}$, ♀ $1\frac{1}{5}$ inch.

Hab. Paraguay.

Types, Mus. Druce.

5 ♂♂, 1 ♀, Mus. Druce; ♂ ♀, British Museum (Crowley Bequest).

Although a very much smaller insect, I believe it to be allied to *T. oreala* Hew.*, to which it has many points of resemblance.

THECLA NISÆE.

Thecla nisæe Godm. & Salv. Biol. Cent.-Am., Rhop. ii. p. 67, pl. 56. figs. 8, 9.

The black apex on the upper side of the fore wing of this species (which is spelt *nicæe* on the plate) varies a good deal in extent, but this does not appear to be confined to any particular locality, although those from N. Granada are perhaps broadest.

In addition to the localities given, Mr. Godman has a male from Rio Juntas, Bolivia, 3000 feet.

T. galliena Hew., a closely allied species, is described from Chontales, but is not included in B. C.-A.

THECLA AHOLIBA.

Thecla aholiba Hew. Ill. Diur. Lep. p. 82, pl. 35. figs. 76, 77 (1867).

Thecla aritides Schaus, P. U.S. Nat. Mus. vol. xxiv. p. 417 (1902).

Hab. Venezuela; New Granada.

I have examined the specimen in Mr. Godman's collection labelled "*aratas*," which is referred to by Mr. Schaus, and find it is identical with Hewitson's type of *T. aholiba*. There is a specimen in the British Museum from the Crowley Collection and we also possess a male; both these are from Venezuela.

THECLA UPUPA, sp. n. (Plate XXXVI. fig. 7.)

Male. Much like *T. epopea* Hew.† Fore wing shorter, outer margin more convex; hind wing less produced anally. Upper side: blue areas brighter, not lutescent and less violaceous; fore wing, black costal and apical areas broader and more clearly defined. Under side: ground-colour darker. Fore wing: inner white line placed more obliquely and breaking into a separate streak near the inner margin; outer white line more continuous and commencing nearer to the apex. Hind wing: both lines

* *Thecla oreala* Hew. Descr. of Lycænidæ, p. 27 (1868).

† *Thecla epopea* Hew. Equat. Lep. p. 61.

very irregular and broken into short streaks; a small white spot situated at the junction of the lower median nervule; red anal areas much less prominent.

Female. Differs only from male in outer margin of hind wing above being more broadly black.

Expanse $1\frac{1}{10}$ inch.

Hab. R. Susio, Costa Rica (*H. Rogers*).

Types, Mus. Godman.

The specimen here described, which I suppose to be the female, appears to have the terminal joint of the palpi shorter than in the male.

Also allied to *T. epopeodes* Schaus (P. U.S. Nat. Mus. vol. xxiv. p. 412, 1902) from Mexico, which I know from the description only.

THECLA PICUS, sp. n. (Plate XXXVI. fig. 9.)

Female. Upper side: fore wing blackish brown, extreme base of cell and inner margin for about three-fourths its length, and extending up to the median nervure, pale shining blue. Hind wing pale shining blue; apex and outer margin narrowly brown; cilia towards anal angle white, tipped with brown. Lobe brown. Under side: ground-colour greyish brown with white bands and spots. Fore wing: a white inwardly dark-bordered band beyond the end of the cell obliquely from the costa to the lower median nervule (below which is a distinct median white dash) followed by a sinuous, white, outwardly dark-bordered band; patches of white scales below the apex and above the submedian nervure towards the margin. Hind wing: a median, white, inwardly dark-bordered, broken band, inwardly curved on the costa, outwardly curved below and angled to the anal margin. A white discal spot and another on the anal margin, near the base. An ultramedian, much broken, outwardly dark-bordered white line commencing on the costa, joining the median band towards the centre of the wing and again angled towards the anal margin below. A dark-red patch crowning a minute black spot above the apex, and another more distinct red patch and small black spot between the lower median nervules placed some distance from the margin and adjoining the ultramedian line. An anteciliary black line towards the anal angle inwardly bordered by a white line. Cilia long, grey, and with a whitish central line. Lobe black, crowned with white and with the area above it slightly cupreous. Tails black, with white tips. Legs white-spotted.

Expanse 1 inch.

Hab. Roraima, British Guiana (*H. Whitely*).

Type, Mus. Godman.

On the under side this insect is marked somewhat like *T. epopea* Hew., but without the male it is impossible to determine whether it is allied to that species or not. The red patch above the apex on hind wing below is a curious character.

THECLA CLEPSYDRA, sp. n. (Plate XXXVI. fig. 10.)

Male. Upper side uniform violaceous blue; costa, apex, and outer margins broadly dark brown; a fine submarginal blue line and some blue scales towards anal angle of hind wing. Cilia concolorous with wings. An indistinct, slightly darker brown patch, occupying the outer half of the cell of the fore wing and apparently bordered on its costal edge by a linear brand-like mark which is only visible in certain lights. On the under side this insect resembles *T. odinus* Godm. & Salv.*, but the ground-colour is darker and the pale linear marking at the end of the cell of the fore wing is absent; the inner line on the hind wing is reduced to a blue spot near the costa and the median line is sinuous, much broken and less angulated, and the red anal patches are entirely absent. The lobe is largely black, and there is a marginal patch of blue scales between the lower median nervules.

Expanse $1\frac{2}{5}$ inch.

Hab. Bogota, Colombia.

Type, British Museum; received from the Crowley Bequest.

THECLA HESPERITIS.

Bithys hesperitis Butl. & Druce, Cist. Ent. i. p. 107 (1872); Lep. Exot. p. 159, pl. 57. fig. 14 (1873).

Thecla lugubris Mösch. Verh. z.-b. Ges. Wien, xxvi. p. 301, tabb. 3, 4 (1876).

T. cabiria Hew. Ill. Diur. Lep. p. 195, pl. 77. figs. 623, 624 (1877).

Tmolus perdistincta Kaye, Trans. Ent. Soc. 1904, p. 194, pl. 18. fig. 18.

Messrs. Godman and Salvin place *T. lugubris* Mösch. as a synonym, and *T. cabiria* Hew. must also be added, the types being quite indistinguishable from many specimens before me from Guiana, Colombia, and Santarem.

The species varies considerably in size.

Mr. Kaye has kindly lent me his type from Trinidad, which I have no doubt is a female, and which does not differ in any way from many specimens from Central America and from Venezuela before me. Mr. Kaye compares it with *T. beon* Cr., from which it is of course quite distinct.

THECLA ARUMA.

Thecla aruma Hew. Ill. Diur. Lep. p. 192, pl. 75. figs. 609, 610 (1877).

Mr. Godman has specimens from Guiana (Roraima and Carimang River) obtained by Whitely.

As pointed out by Hewitson, the red spots near anal angle of hind wing below vary a good deal in colour and are sometimes nearly obsolete.

* *Thecla odinus* G. & S., B. C.-A., Lep. Rhop. vol. ii. p. 70, pl. 56. figs. 20, 21 (1887).

THECLA PARTUNDA.

Thecla partunda Hew. Ill. Diur. Lep. p. 206, pl. 72. figs. 685, 686 (1877).

Thecla origo Godman & Salvin, Biol. Cent.-Am., Lep. Rhop. ii. p. 73, pl. 56. figs. 32, 33 (1887).

Amongst Mr. Godman's series of *T. origo* are specimens agreeing exactly with Hewitson's type on both surfaces.

THECLA VITRUVIA.

Thecla vitruvia Hew. Ill. Diur. Lep. p. 193, pl. 77. fig. 613 (1877).

Hab. Pará, Brazil.

This insect so far as I know is unique, as I am unable to find any specimens which agree exactly with the type in the British Museum. The next four here described are closely allied and may eventually prove to be forms of *T. vitruvia*, but for the present it appears to me advisable to keep them distinct.

The shade of blue in all is much the same and the black outer marginal border to the hind wing above is of equal width.

T. fortuna is exactly like *T. vitruvia* on the upper side, but the spot close to the line on the hind wing below is red, in place of dark brown (almost black) in that species.

T. torqueor has a blue patch on the inner margin of the fore wing above equally divided by the submedian nervure and is without any blue scales in the cell. On the under side it resembles *T. fortuna*.

T. indigo has the inner margin of the fore wing above blue only below the submedian nervure. On the under side the anal spots are brown.

T. anfracta is without the blue on the fore wing, and on the under side resembles *T. vitruvia*.

THECLA FORTUNA, sp. n.

Male. Resembles *T. vitruvia* Hew. on both surfaces, but the spot close to the line on the hind wing below is red in place of dark brown.

Expanse $1\frac{1}{5}$ inch.

Hab. Yurimaguas, Peru; Tapajos, Amazons (*Bates*).

Types, Mus. Godman.

THECLA TORQUEOR, sp. n.

Male. Differs from *T. vitruvia* Hew. in the blue on the upper side being somewhat lighter in shade and on the fore wing reduced to a patch on the inner margin. Under side as in *T. fortuna*.

Expanse $1\frac{3}{10}$ inch.

Hab. Carimang River, British Guiana (*H. Whitely*).

Type, Mus. Godman.

Whitely obtained a series of specimens which do not differ.

THECLA INDIGO, sp. n.

Male. Upper side differs from that of *T. vitruvia* Hew. in the fore wing being marked by a narrow blue streak only on the inner margin below the submedian nervure. On the under side the anal spots are brown and the submarginal shades and lunules on both wings are more clearly defined.

Expanse 1 inch.

Hab. Chapada Campo, Brazil (*H. H. Smith*).

Type, Mus. Godman.

This insect is a good deal smaller than its allies. Captured by Mr. Smith in January.

THECLA ANFRACTA, sp. n.

Male. Allied to *T. vitruvia* Hew. Differs on upper side in the fore wing being wholly greenish black. Under side as in *T. vitruvia*.

Expanse $1\frac{3}{10}$ inch.

Hab. Chancamayo, Peru (*H. Whitely*).

Type, Mus. Godman.

THECLA THAMA.

Thecla thama Hew. Ill. Diur. Lep. p. 189, pl. 75. figs. 591, 592 (1877).

Hewitson's type, although stated by him to be in Mr. Grose Smith's collection, cannot be found there, and is doubtless the specimen labelled "*thama*" now in the Hewitson Collection in the British Museum. The Museum Collection also contains a specimen from Bogota.

THECLA ATROX.

Thecla atrox Butler, Trans. Ent. Soc. 1877, p. 140.

This insect probably belongs to the group which contains *T. thama* Hew.

Mr. Godman has specimens from the Carimang River, British Guiana (*Whitely*), and from Cayenne, also from Santarem and Tapajos. We have it also from Cayenne and from Juhety, Amazons. The female appears to differ only from the male in being paler on both surfaces.

THECLA BEON.

Papilio beon Cr. Pap. Exot. iv. pl. 319. figs. B, C.

Tmolus isobeon Butl. & Druce, Cist. Ent. i. p. 108.

Thecla bactra Hew. Ill. Diur. Lep. p. 194, pl. 77. figs. 619, 620.

Thecla caulonia Hew. ibid. p. 188, pl. 75. figs. 587, 588.

Thecla vibulena Hew. ibid. p. 190, pl. 76. figs. 599, 600, 601, 602, 603.

Thecla bellera Hew. ibid. p. 194, pl. 77. fig. 618.

Messrs. Godman and Salvin (Biol. Cent.-Am., Lep. Rhop. ii. p. 75) have pointed out that the first three names are synonymous, and after examining the types of the remaining three, I am of the same opinion as regards them. *T. bellera* has the median band on the under side narrow and browner, but I can distinguish no characteristic of sufficient importance to separate it.

Mr. W. J. Kaye writes (Trans. Ent. Soc. 1904, p. 192) that he has four large males taken at Verdant Vale (in Trinidad) which scarcely have any blue on the fore wing except on the inner margin; one male is the *bactra* of Hew., etc. My own opinion is that the male never has any trace of blue on the fore wing and that all those specimens which have blue on the fore wing are females.

This is the southern form of *T. cecrops* Fab., and is evidently regarded as the same species by Scudder in his work 'The Butterflies of the Eastern United States and Canada,' vol. iii. p. 1821 (1889), as he records it from Guatemala and Panama.

Thecla sangala.

Thecla sangala Hew. Descr. of *Thecla*, p. 35 (1868).

Thecla sangala Hew. Ill. Diur. Lep., Lycænidæ, p. 132, pl. 54. figs. 314, 315 (1869).

Thecla autoclea Hew. ibid. p. 194, pl. 77. figs. 616, 617 (1877).

Thecla autoclea Godm. & Salv. B. C.-A., Rhop. ii. p. 76, pl. 57. figs. 9, 10 (1887).

I can find no points of difference between the type of *T. autoclea*, which is without doubt a female, and that of the previously described *T. sangala* except in size. Venezuelan specimens of both sexes appear to be rather larger than those from Central America. Hewitson's figures are rather different, but the figure of the upper side of *T. autoclea* (617) is too highly coloured.

Thecla lorina.

Thecla lorina Hew. Ill. Diur. Lep. p. 181, pl. 71. figs. 539, 540.

The type and another in poor condition are now in Mr. Godman's collection and are the only specimens I have seen. They were formerly in the Kaden Collection, and may have come from Venezuela, but their origin is not recorded. Hewitson states that he describes the male, but I am of opinion that both are females.

Thecla perisus, sp. n.

Male. Upper side uniform dull brown; a small orange spot at anal angle of hind wing. Under side: ground-colour pale brown with linear white-edged bands and shades as in *T. denarius* Butler & Druce*, but with the ultramedian band on the fore wing parallel with the outer margin, not placed obliquely as in that species.

Expanse $1\frac{1}{5}$ inch.

* *Tmolus denarius* Butl. & Druce, Cist. Ent. i. p. 109.

Hab. Venezuela.

Type, Mus. Godman.

The type was formerly in the Kaden Collection and has a MS. label attached to it, "*perisus* Moritz." Allied to *T. denarius*, but distinguished by the absence of the cupreous on the fore wing above and the pale ground-colour below.

THECLA CALLAO, sp. n. (Plate XXXVI. fig. 11.)

Male. Upper side—Fore wing dull cupreous, with the costa, apex, and outer margin pale brown. Hind wing pale brown, slightly cupreous over the abdominal and basal areas which are thickly clothed with yellowish hairs. Cilia of both wings long, pale brown and whitish towards anal angle of hind wing; tail brown, tipped with white. Underside—Fore wing dark brownish grey, a very faint double mark at the end of the cell; a linear ultramedian russet-brown band, outwardly edged with pale grey, reaching from the costa almost to the submedian nervure. A submarginal row of minute pale grey crescent-shaped lunules. A fine anteciliary dark line. Cilia dark grey. Hind wing: a sinuous, median, russet-brown line outwardly edged with pale grey, commencing on the costal margin and angled above the lobe to the abdominal margin; the ground-colour within this linear band is very dark, and without it very pale, becoming darker again towards the margin. A submarginal row of pale lunules as in fore wing and a marginal row of dark shades. A small black, red-crowned spot between the lower median nervules, followed by a patch of bluish-grey and black scales. Lobe black, crowned by a small red spot and a white dot. Abdomen dark above, pale straw-colour below.

Female. Upper side pale brown. Fore wing slightly cupreous over discal areas. Hind wing with faint indication of a red spot on margin between lower median nervules. Under side as in male but paler.

Expanse ♂ ♀ $1\frac{1}{20}$ inch.

Hab. Callao, Peru (*Walker*).

Types, Mus. Godman.

Several specimens were captured by Commander J. J. Walker, and I am unable to trace that it has been described.

THECLA RUGATUS, sp. n.

Male. Upper side uniform dull olivaceous brown; abdominal areas of hind wing thickly clothed with cupreous hairs and a small orange spot in the lobe. Cilia concolorous with wings but whitish towards lobe. Under side: ground-colour uniform pale olivaceous brown, with a common, nearly straight, distinct, rather broad, linear dark orange band, outwardly bordered by a fine black line and again by a clear white line and angled above the lobe to the abdominal margin. A submarginal row of dark shades to both wings. A large bright orange spot between the lower median nervules on the hind wing surmounting a black marginal spot. A patch of greyish scales beyond. Lobe black, crowned by an orange streak and a minute white dot. Abdomen brown above, white below.

Female. Upper side paler than in male; hind wing with orange marginal spots between veins one and two and two and three. Under side as in male, but ground-colour paler and orange band broader.

Expanse, ♂ $1\frac{1}{10}$, ♀ 1 inch.

Hab. Vina, N.W. Peru, 5500 ft. (*O. T. Baron*).

Types, Mus. Godman.

Allied to *T. denarius* Butl. & Druce, and *T. sethon* G. & S., but has many points of distinction.

THECLA NUBILUM, sp. n.

Male. Allied to *T. sethon* G. & S.* Upper side uniform dark blackish brown with no cupreous on the discal areas, a minute orange spot on lobe. Under side: ground-colour of a greyer shade and the transverse bands much narrower, straighter in the fore wing, and placed nearer to the outer margins. Tails black, tipped with white.

Expanse $1\frac{3}{10}$ inch.

Hab. Castro, Parana, Brazil (*E. D. Jones*).

Type, Mus. Druce.

Mr. Jones obtained a series of this insect, which was considered by Mr. Schaus to be *T. suada* Hew., but that name was sunk by Hewitson himself as a synonym of his *T. ceromia*, Ill. D. Lep. p. 207, which belongs to another group.

THECLA CUPA, sp. n. (Plate XXXVI. fig. 12.)

Male. Upper side much like *T. laconia* Hew. ♂ †, but blue extending over cell of fore wing, and costal margin of hind wing more broadly black. A small indistinct circular brand at the end of the cell of fore wing, in place of the elongate oval brand of *T. laconia*. Under side with markings and shades much as in *T. laconia*; ground-colour paler and the transverse bands on both wings inwardly bordered with brown, that on the fore wing having its lower half placed further out towards the margin.

Female. Upper side uniform dull brown; under side as in male.

Expanse, ♂ $1\frac{1}{20}$, ♀ $\frac{9}{10}$ inch.

Hab. Rio Grande, Brazil.

Types, Mus. Druce.

It is also much like *T. ophia*, Hew. ‡ (the type of which together with that of *T. laconia* is now in Mr. Godman's collection), but that insect is without the brand on the fore wing. The discal spot on the fore wing of *T. ophia* mentioned by Hewitson is very difficult to see, but can be best observed by holding the insect against a strong light.

* *Thecla sethon* G. & S., B. C.-A., Lep. Rhop. vol. ii. p. 77, pl. 57. figs. 14, 15 (1887).
† *Thecla laconia* Hew. Descr. of *Thecla*, p. 10.
‡ *Thecla ophia*, Hew. ibid. p. 6.

THECLA ATRIUS.

Thecla atrius * Herr.-Schäff. Exot. Schmett. figs. 53–54.

Tmolus clitumnus Butl. Trans. Ent. Soc. 1877, p. 140, pl. 3. fig. 6.

Dr. Butler's type does not differ in any way from the well-known *T. atrius*, and in the British Museum was latterly placed by him under that name.

THECLA CALOR, sp. n.

Male. Closely allied to *T. atrius* Herr.-Schäff. Upper side: fore wing dull dark greyish brown, not black as in that species; hind wing pale shining blue, costal margin narrowly whitish. Anal margin whitish, cilia pale. Under side as in *T. atrius*, but linear bands on both wings inwardly edged with vermilion and broadest on hind wing. Abdomen pale on both surfaces.

Female. Upper side uniform dull brown; inner marginal area of hind wing bluish grey. A small red spot in the lobe. Under side as in male, but ground-colour paler.

Expanse ♂ ♀ $1\frac{1}{10}$ inch.

Hab. Brazil, Tapajos River; Chapada Campo (*H. H. Smith*). Mus. Godman.

Types, Mus. Druce.

Mr. Smith's specimens were captured in November and December.

THECLA PETAURISTER, sp. n.

Male. Upper side: differs from *T. calor* by inner margin of fore wing being pale shining blue, extending upwards almost to the lower median nervule. Under side as in *T. atrius*.

Expanse 1 inch.

Hab. Quonga, British Guiana (*Whitely*).

Type, Mus. Godman.

We have a specimen which was formerly in the Kaden Collection which is identical with the type but is without locality.

The last three forms and indeed the following may eventually prove conspecific with *T. atrius*.

THECLA COS, sp. n. (Plate XXXVI. fig. 13.)

Male. Allied to *T. atrius* H.-S. Upper side: fore wing black, slightly olivaceous in tone; hind wing rich dark shining blue, with the costal, outer and inner margins broadly black. A dull red dot in the lobe. Under side as in *T. atrius*.

Female like male, but blue area paler, less shining and more restricted.

Expanse ♂ ♀ $1\frac{1}{10}$ inch.

Hab. Bartica, British Guiana (*H. S. Parish*); British Guiana

* Misspelt "*atnius*" by Hewitson and Kirby.

(*Whitely*), Mus. Druce; Tapajos River (*Bates*), Mus. Godman & Brit. Mus.

Type, Mus. Druce.

THECLA CENTORIPA.

Thecla centoripa Hew. Descr. of Lycænidæ, p. 23 (1868); Ill. Diur. Lep. p. 183, pl. 73. figs. 562–563 (1874).

Thecla hahneli Staud. Exot. Schmett. p. 286, pl. 97 (1888).

The linear spot at the end of the cell, although described by Hewitson, is not shown in his figure. Staudinger's figure shows it distinctly.

THECLA OLERIS, sp. n. (Plate XXXVI. fig. 14.)

Male. Upper side dull uniform brown, slightly olivaceous in tone. Under side bright green, inner margin of fore wing (which is without markings) greyish. Hind wing: a paler green mark at the end of the cell and a faint linear ultramedian tortuous line inwardly bordered with a faint black line, from the costal margin just before the apex to the abdominal margin. A minute black dot at the extreme anal angle faintly crowned with yellowish. A minute green spot between the eyes. Palpi grey, with black hairs; terminal joint black, clubbed, with white tips. Thorax and abdomen greyish.

Expanse $\frac{9}{10}$ inch.

Hab. S. Paraguay (*Perrens*).

Type, Mus. Godman.

This little insect is perhaps allied to *T. gabina* G. & S.* and has a short tail as in that species, but is without the blue areas on the upper side and is different below. In *T. gabina* the space between the eyes is bright green, as are the palpi.

THECLA CÆSPES, sp. n. (Plate XXXVI. fig. 18.)

Female. Allied to *T. lampetia* G. & S.† Upper side dark cærulean blue, with costa, apex, and outer margins of both wings blackish grey. Head, collar, space between the eyes, tegulæ and base of costal margin of fore wing bright shining bronze-green. Extreme costal edge of fore wing cupreous brown. Cilia of fore wing bright cupreous brown, also of hind wing from apex to lower median nervule, whence it becomes white with black tips to anal angle. Tail black tipped with white. Under side uniform dull bronze-green, the green scales apparently overlying a pale cupreous ground-colour. Inner margin of fore wing broadly pale cupreous. White linear bands and deep red spots much as in *T. lampetia*, but red spot below median nervure absent. Abdomen blackish above, cupreous below. Palpi emerald-green, terminal joint short, black and pale-tipped. Legs distinctly black and white spotted.

Expanse $1\frac{1}{10}$ inch.

* *Thecla gabina* G. & S., B. C.-A., Lep. Rhop. vol. ii. p. 82, pl. 57. figs. 20, 21 (1887).

† *Thecla lampetia* G. & S., B. C.-A., Lep. Rhop. vol. ii. p. 83 (1887).

Hab. La Paz, Bolivia (*Garlepp*).

Type, Mus. Druce.

Distinguished at once from *Thecla lampetia* by the cupreous cilia, that species having them concolorous with the wings. The type of *T. lampetia* is in bad condition, and it is not possible to say whether the tegulæ and base of fore wing are bronze-green as in the species above described, but I can discover no trace of it.

THECLA BADETA.

Thecla badeta Hew. Ill. Diur. Lep. p. 146, pl. 58. figs. 365–366, & p. 202, pl. 80. figs. 657–658 (1873).

This is a puzzling species, and very little more is known about it than in Hewitson's time. More recent female specimens contained in Mr. Godman's collection from Colombia and from Paraguay (*Perrens*) are all slightly tinted with blue on the upper side, but do not appear to differ below. Messrs. Godman & Salvin (B. C.-A. p. 83) consider that *T. badeta* is a uniform brown insect. Mr. Godman has two, ♂ ♀, from Rincon, Guerrero, Mexico, 2800 feet, captured in October by Mr. H. H. Smith: both are exactly alike on the under side; the female has the inner marginal half of the fore wing and the whole of the hind wing dull blue. The upper side of the male is a dark shining uniform purple-blue with the costa and apex of the fore wing black, whilst the hind wing is without the tail, which is present on the lower median nervule in all the females I have examined, and the cilia appear to be quite perfect.

Thecla carla Schaus* from Colombia may be allied to this species. The male only is described and as without tails, but the reddish outer line on hind wing below seems to distinguish it.

THECLA THESPIA.

Thecla thespia Hew. Equat. Lep. p. 65 (1870); Ill. Diur. Lep. p. 165, pl. 65. figs. 455–456 (1874), ♂.

Female. Upper side pale shining violaceous blue; costa, apex, and outer margin of fore wing and apex of hind wing broadly dark grey. Under side as in male, but ground-colour much paler and red patches towards anal angle more extensive and confluent.

Hab. Pebas, Upper Amazons. Mus. Godman.

THECLA PHOTISMOS, sp. n. (Plate XXXVI. fig. 15.)

Male. Allied to *T. thespia* Hew. Upper side brilliant, shining cærulean blue; apex and outer margin of fore wing broadly, and apex of hind wing narrowly, blackish brown. Under side greenish grey with white bands as in *T. thespia*, but without the red spot near the apex of the hind wing, and with one large red area near the anal angle containing a deep black marginal spot between the lower median nervules. Palpi white, terminal joint long and slender, black.

* *Thecla carla* Schaus, P. U.S. N. M. vol. xxiv. p. 408 (1902).

Expanse $1\frac{1}{5}$ inch.

Hab. Sarayacu, Ecuador (*Buckley*).

Type, Mus. Godman.

This species, like many others of the group, has distinct white inner borders to the eyes.

Thecla bosora Hew. (Equat. Lep. p. 66; Ill. Diur. Lep. p. 166, pl. 65. figs. 459–460, 1874) is perhaps allied to the two preceding species, but has a large dark discal spot on the upper side of the fore wing, and a narrow white line closing the cell of the same wing below which is not mentioned by Hewitson and is not shown in his figure. Mr. Godman has three males from Sarayacu, Ecuador, collected by Buckley.

THECLA TEGULA.

Thecla tegula Hew. Descr. of *Thecla*, p. 4; Ill. Diur. Lep. p. 129, pl. 52. figs. 291, 292 (1869).

Female. Differs from the male in being without the long discal brand of the fore wing and the bluish-grey scales near the anal angle of the hind wing.

Hab. Amazons (*Bates*).

Mr. Godman's collection now contains Hewitson's type (male) and the female here described.

THECLA MANTICA, sp. n. (Plate XXXVI. figs. 16 ♂, 17 ♀.)

Male. Upper side—Fore wing dark brown; basal half of inner margin pale greyish blue extending upwards to median nervure. A large dull black oval brand occupying most of the cell and surrounded by greyish silky scales. (In some specimens this black brand becomes dark buff, which appears to be caused by the black scales having dropped or been rubbed off.) Hind wing: discal area pale greyish blue; costal, apical, and outer margins broadly dark brown; bluish marginal scales and a black anteciliary line from median nervure to submedian nervure. Lobe and above it dark orange-red. Cilia of fore wing brown; of hind wing brown to median nervure, whence it becomes whitish tipped with brown to anal angle. Under side—ground-colour uniform pale brown. Fore wing: an ultramedian linear band composed of separated black markings outwardly bordered with white. Hind wing: a rather broad outer marginal band composed of dark red irregular patches and separated by the nervules, from the apex to the anal angle. Within this band are several black dots outwardly edged with pure white and irregularly placed, whilst the apical end of the said band is bordered on both sides by black and again by white. Cilia as on upper side. Tails black, tipped with white.

Female. Upper side uniform dark brown; basal areas of both wings dusted with a few bluish scales. A submarginal grey line on hind wing from upper median nervule to lobe. Lobe and the two interspaces beyond with dark orange-red spots. (In some specimens the lobe only is red.) Cilia as in male. Abdomen rown above, pale below.

Expanse ♂ ♀ $1\frac{1}{5}$–$1\frac{2}{5}$ inch.

Hab. Chapada Campo, Brazil (*H. H. Smith*), September and November.

Types, Mus. Godman.

Mr. H. H. Smith obtained a good series of this curious species, but Mr. E. D. Jones, who collected in this district for some years, informs me that he never met with it.

THECLA CÆSARIES, sp. n. (Plate XXXVI. fig. 19.)

Male. Allied to *T. ledæa* Hew. *, but smaller. Upper side dark indigo-blue, with apex and outer margins of both wings broadly black. Under side: ground-colour steely grey, with the yellow anal area as in *T. ledæa*, but more extensive, and the ultramedian line on both wings placed further in and in the hind wing touching the white mark at the end of the cell.

Expanse $1\frac{3}{20}$ inch.

Hab. Bartica, British Guiana (*H. S. Parish*).

Type, Mus. Druce.

Mr. Godman has a female specimen labelled "Santa Martha" which may belong to this species, but the ground-colour below is a creamy shade and the brownish inner border to the linear bands is wider, so that in the absence of the male it must remain doubtful. The female of *T. ledæa* is undescribed. *T. cæsaries*, like *T. ledæa*, is without any trace of a brand.

THECLA PALUMBES, sp. n.

Male. Allied to *T. cerata* Hew.†, which it closely resembles on the upper side. On the under side it is quite different, being entirely without the distinct linear band common to both wings, also the red spot within its angles towards the anal margin of hind wing. The ground-colour is more creamy and less shining.

Expanse $1\frac{3}{10}$ inch.

Hab. Cayenne, Guiana.

Type, Mus. Godman.

The type has a red spot in the lobe above, but this is not a constant character in *T. cerata.*

THECLA PENNATUS, sp. n.

Male. Allied to *T. anthora* Hew.‡ Upper side uniform dark brown, with inner margin of fore wing narrowly, and discal and basal areas of hind wing shining opalescent indigo-blue. Under side: ground-colour duller; the linear bands narrower, placed further in from the margin and in the hind wing not inwardly bordered with red. The upper red marginal spot with the black pupil of *T. anthora* is absent, and the large red spot contained

* *Thecla ledæa* Hew. Descr. of *Thecla*, p. 8.

† *Thecla cerata* Hew. Ill. Diur. Lep. p. 191, pl. 76. figs. 607, 608 (1877).

‡ *Thecla anthora* Hew. Ill. Diur. Lep. p. 191, pl. 76. figs. 604–606.

in the angle of the ultramedian band is replaced by a black, smaller spot.

Female. Upper side uniform dull dark brown; under side as in male.

Expanse, ♂ $1\frac{1}{5}$, ♀ $1\frac{1}{10}$ inch.

Hab. Amazons: Tapajos, Ega, Pará (*Bates*).

Types, Mus. Godman,

This insect, which I believe to be quite distinct, was separated by Bates, but does not appear to have received a name.

THECLA PISIDULA, sp. n.

Male. Allied to *T. pisis*, G. & S.* Upper side dark indigo-blue with ill-defined narrow black margins. Under side much as in *T. pisis*, but with ground-colour darker and more olivaceous and the twin red patch on hind wings reduced to a single dull red, much reduced spot between the lower median nervules.

Female. Upper side: discal areas suffused with pale blue, especially on hind wing and along inner margin of fore wing. Under side: ground-colour paler than in male and marginal shades in both wings more prominent.

Expanse, ♂ $1\frac{1}{4}$, ♀ $1\frac{1}{10}$ inch.

Hab. Rio Grande, Brazil.

Types, Mus. Druce.

Different on both surfaces from *T. pisis.*

THECLA INSTITA, sp. n.

Male. Upper side rich dark brown without purplish reflections. Under side as in *T. pisidula*, but ground-colour darker.

Expanse $1\frac{1}{10}$ inch.

Hab. Chapada Campo, Brazil (*H. H. Smith*), January and March.

Type, Mus. Godman.

Mr. Smith captured two specimens. On the upper side it closely resembles *T. puppius* G. & S.†, but is browner and is different below.

THECLA MELEAGER, sp. n.

Male. Allied to *T. pisis* G. & S., which it closely resembles on the upper side; but on the under side the ground-colour is dark greenish grey, the red spots on the hind wing are less extensive and darker, and the black spots larger and more prominent.

Female as male, slightly paler.

Expanse as *T. pisis.*

Hab. Surinam.

Types, Mus. Druce.

This is probably the southern form of *T. pisis* and should perhaps be treated as a subspecies. We have a series of seven specimens which do not vary.

* *Thecla pisis* G. & S., B. C.-A., Lep. Rhop. vol. ii. p. 84, pl. 57. figs. 24, 25 (1887).
† *Thecla puppius*, G. & S., B. C.-A., Lep. Rhop. vol. ii. p. 84 (1887).

THECLA CELMUS.

Papilio celmus Cr. Pap. Exot. iv. pl. 55. figs. G, H.
Tmolus pereza Butler, Trans. Ent. Soc. 1877, p. 140.

Dr. Butler's type in the British Museum does not differ in any way from Cramer's insect.

THECLA EMENDATUS, sp. n. (Plate XXXVI. fig. 20.)

Male. Allied to *T. carnica* Hew.* Upper side lighter and brighter blue, apex of fore wing broadly and evenly black; costa and apex of hind wing less broadly black than in *T. carnica.* Under side as in *T. carnica*, with the white marginal shades somewhat more prominent.

Expanse $\frac{9}{10}$ inch.

Hab. Rio Juntas, Bolivia, 3000 feet (*Garlepp*).

Type, Mus. Druce.

Also in the British Museum from Bolivia (Crowley Bequest). Distinguished at once by its broad black apex. It is also much like *T. seudiga* Hew.† on the under side, but differs above.

THECLA DICÆA.

Thecla dicæa Hew. Ill. Diur. Lep. p. 179, pl. 70. figs. 531, 532 (1874).

Thecla farmina Schaus, P. U.S. Nat. Mus. vol. xxiv. p. 421 (1902).

Hab. Castro, Parana, Brazil (*E. D. Jones*).

Mr. Jones has lent me a co-type of Mr. Schaus's insect, which I quite fail to distinguish from Hewitson's type in the British Museum. Mr. Schaus describes a female; Hewitson a male. If both are correct, there is no difference between the sexes. Hewitson does not give a locality.

THECLA CALCHINIA.

Thecla calchinia Hew. Descr. of *Thecla*, p. 21 (1868); Ill. Diur. Lep. p. 145, pl. 57. figs. 359, 360.

Male. Upper side uniform dull brown, with a dark marginal spot on hind wing between lower median nervules crowned with dull red.

Hab. Amazons, Ega and Pará (*Bates*); British Guiana, Roraima (*Whitely*). Mus. Godman.

In the male specimen from British Guiana referred to above the blue areas are rather less extensive and less violaceous.

THECLA DOLIUM, sp. n.

Male. Much like *T. fabulla* Hew.‡ Upper side: basal half of fore wing and whole of hind wing (excepting costal margin which is narrowly greyish brown) dull purplish blue, brilliant in some

* *Thecla carnica* Hew. Ill. Diur. Lep. p. 143, pl. 57. fig. 352 (1873).
† *Thecla seudiga* Hew. ibid. p. 152, pl. 60. figs. 397, 398 (1874).
‡ *Thecla fabulla* Hew. Descr. of *Thecla*, p. 20 (1868).

lights. The brand at the end of the cell is circular and simple, not compound as in *T. fabulla*. Under side with markings much like *T. fabulla*, but paler and more distinctly edged with white. The transverse band of the fore wing is more irregular and appears to be closer to the end of the cell, whilst that on the hind wing appears to be less inclined to break up into spots. The ground-colour is paler and the red patch at the extreme anal angle is almost obsolete.

Expanse $1\frac{1}{20}$ inch.

Hab. Honduras.

Type, British Museum.

Distinguished from *T. fabulla* by the simple brand and the different shade of blue.

THECLA VENA, sp. n. (Plate XXXVI. fig. 21.)

Male. Closely allied to *T. cruenta* Gosse *. Upper side differs in cilia of fore wing being bright orange instead of dull brown. Under-side markings much as in *T. cruenta*, but ultramedian band on fore wing straighter and cilia on same wing deep orange. Head and space between the eyes deep red.

Female. Upper side differs from that sex of *T. cruenta* in hind wing being entirely pale blue, with a large white patch on costal margin near apex. Under side as in male. Cilia of fore wing orange on both surfaces.

Expanse, ♂ $1\frac{1}{10}$, ♀ $\frac{9}{10}$ inch.

Hab. Vina, N.W. Peru, 5500 feet (*O. T. Baron*).

Types (2 ♂ ♂, 1 ♀), Mus. Godman.

THECLA MEGACLES.

Papilio megacles Cr. Pap. Exot. iv. pl. 333. figs. E, F (1782).

Thecla adria Hew. Ill. Diur. Lep., Lycænidæ, p. 142, pl. 56. figs. 345, 346 (1873).

Hab. Venezuela, Surinam, Amazons.

The female differs from the male on the upper side in the inner margin of the fore wing being broadly white from the base almost to the outer angle, slightly bluish near the base, and in the hind wing being pure white, with the markings of the under side showing through. There is a linear black margin just inside the white fringe near the anal angle, also a minute dark spot between the lower median nervules and another at the anal angle.

THECLA UNA.

Thecla una Hew. Ill. Diur. Lep., Lycænidæ, p. 140, pl. 56. figs. 336, 337 (1873).

Thecla lenis Capr. Ann. Soc. Ent. Belg. xvii. p. 16, pl. i. fig. 3 (1874).

Capronier's figure is an excellent representation of a female specimen.

* *Thecla cruenta* Gosse, 'Entomologist,' xiii. p. 203, pl. 2. fig. 4 (1880).

THECLA FURCIFER, sp. n.

Male. Closely allied to *T. una* Hew.* Upper side much as in that species, but white areas of hind wing suffused with pale greyish blue. Under side pale grey, with sordid-white-edged bands and spots, slightly darker than the ground-colour, arranged as in *T. una*. The red crowns to the black dots on margin near anal angle of hind wing are absent.

Expanse $1\frac{1}{5}$ inch.

Hab. Espiritu Santo, Brazil.

Type, Mus. Druce. Also in the British Museum.

The female of *T. una* has more extensive white areas, and in some specimens whitish tips to the fore wings.

THECLA CLEON.

Papilio cleon Fab. Syst. Ent. p. 522 (1775).

Tmolus cleon Butl. Cat. Fab. Diur. Lep. p. 188, pl. ii. figs. 4–6 (1870).

Thecla cleon Hew. Ill. Diur. Lep. p. 142, pl. 56. figs. 347–349 (1873).

T. ecbatana Hew. ibid. pl. 40. figs. 525, 526 (1874).

I have examined the type in the Banksian cabinet, and although it is in a very bad state of preservation there is enough of it remaining for identification. I have no doubt that it is a female, and that the males only have the inner margin of the fore wings blue. There are a number of specimens before me from the Amazon regions, and we have recently received examples from Trinidad (*Birch*).

On the under side the males appear to be always clouded, especially towards the base, and in both sexes there is a mark closing the cell in both wings.

THECLA PICENTIA.

Thecla picentia Hew. Ill. Diur. Lep. p. 138, pl. 55. figs. 328, 329.

Hab. Tapajos, Amazons.

The female only appears to be known, and the type is now in Mr. Godman's collection, which also contains another specimen considered by Bates to represent the same species. It does not, however, agree very well, as the ground-colour is darker and the transverse bands are redder, and in the fore wing narrower and in the hind wing wider. The red spot on the hind wing between the lower median nervules is also much larger.

The British Museum Collection contains a male which may possibly prove to be *T. picentia*. On the upper side it is wholly dark brown, with a darker patch at the end of the cell of the fore wing, and on the under side the ground-colour is greyer and the bands are narrower and more sinuous. It is labelled "Bogota," and if it should prove distinct may be named *Thecla rubifer*. The head, the space between the eyes, and the base of the costa

* *Thecla una* Hew. Ill. Diur. Lep. p. 140, pl. 56. figs. 336, 337 (1873).

are red. *T. picentia* Hew. appears to be without marks closing the cells on the under side of both wings.

THECLA VERBENACA, sp. n. (Plate XXXVI. fig. 24.)

Male. Upper side: fore wing dark cærulean blue, with the costa, apex to end of the cell, and outer margin black; a deeper black patch beyond the end of the cell. Hind wing blue as in fore wing, with the costa widely and outer margin narrowly dull black. Lobe bright orange. Submedian nervure and anal fold, which is greyish, thickly clothed with black hairs. Tails black tipped with white. Under side: ground-colour greenish grey, slightly shining. Fore wing with an ultramedian linear dark band, outwardly sordid white, running almost parallel with the outer margin, and a very faint submarginal row of shades invisible at the apex and outer angle. Hind wing with a similar more clearly-defined linear band, commencing on the costa in a single spot, just before the apex, and angled towards the abdominal margin, where it becomes doubled and which it reaches about the middle. Within the angles near the margin are some reddish scales. Without this linear band the anal half of the wing is occupied by two large confluent orange-red patches crowning a black lobe, and a small black marginal spot between the lower median nervules; above these red patches and extending to the apex are two rows of whitish submarginal shades. An anteciliary white line near anal angle. Cilia of both wings dark grey. Antennæ and legs black and white spotted.

Expanse $1\frac{1}{5}$ inch.

Hab. Brazil.

Type, British Museum.

Not closely allied to any with which I am acquainted, but perhaps belonging to the group which contains *Thecla mathewi* Hew. I have not seen the female.

THECLA CINNIANA.

Thecla cinniana Hew. Ill. Diur. Lep. p. 189, pl. 75. figs. 593, 594 (1877).

The male differs from the female in the costal half of the hind wing above being dark brown. I was unable to find the type in Mr. Grose Smith's collection, but there is a specimen in the Hewitson Collection at the British Museum which is probably it.

THECLA PLUMANS, sp. n.

Male. Closely allied to *T. cinniana* Hew. Upper side wholly uniform dark brown, with a few pale blue scales on the inner margin of the fore wing and over the anal margin of the hind wing. Under side as in *T. cinniana*.

Expanse 1 inch.

Hab. Chapada Campo, Brazil (*H. H. Smith*).

Type, Mus. Godman.

Taken by Mr. Smith in December. This is perhaps a local race of *T. cinniana*, but seems distinct enough to require a name.

THECLA AZIA.

Thecla azia Hew. Ill. Diur. Lep., Lycænidæ, p. 144, pl. 57. figs. 357, 358 (1873).

Thecla nipona Hew. ibid. p. 204, pl. 81. figs. 673, 674, 675 (1877).

Mr. Grose Smith has kindly shown me his type of *T. nipona*, and I have no hesitation in sinking this name as a synonym.

Mr. Godman's collection contains a large series from Mexico to S. Paraguay, showing all intermediate forms together with typical forms from various localities.

Hewitson states that his figure of *T. azia* represents a male, but I am inclined to think that the absence of the dark discal spot on fore wing indicates a female.

THECLA VOLUMEN, sp. n.

Upper side uniform dull brown, a minute red spot in the lobe. Tail black tipped with white. Under side: ground-colour and markings much as in *T. picentia* Hew.

Expanse $\frac{4}{5}$ inch.

Hab. Rio, S. Brazil; Chapada Campo, Brazil (*H. H. Smith*).

Type, Mus. Druce.

This obscure insect, although much like *T. picentia* Hew. on the under side, has one tail only, and that on the lower median nervule, as in *T. azia* Hew. The specimen from Chapada Campo was captured in January and is in Mr. Godman's possession. I cannot satisfactorily determine the sex of the specimens described, but I believe them to be males.

THECLA VIDULUS, sp. n.

Male. Upper side: fore wing uniform dull black; hind wing cærulean blue gradually blackening towards the base; costal margin and extreme apex dull black. Under side: bands and markings as in *T. cinniana* Hew., but ground-colour darker and red band on hind wing very much wider. Two parallel red lines closing the cell of hind wing.

Expanse $1\frac{2}{5}$ inch.

Hab. Ecuador.

Type, British Museum (Hew. Coll.).

Apparently allied to *T. cinniana*, but a much larger insect. It was placed by Hewitson in his cabinet without a name, and was probably collected by Buckley.

THECLA RUFO-FUSCA.

Thecla rufo-fusca Hew. Ill. Diur. Lep. p. 96, pl. 78. figs. 627, 628 (1877).

Thecla lucaris Weeks, P. New Eng. Zool. Club, vol. ii. p. 102 (1901); Ill. Diur. Lep. p. 42, pl. 10. fig. 1 (1905).

Described by Hewitson from an unknown locality. Ranges from Mexico to Brazil and the West Indies. Mr. Weeks's figure appears to be that of a male, and is an excellent representation of the insect described by Hewitson.

THECLA SYLLIS.

Thecla syllis Godm. & Salv. B. C.-A., Lep. Rhop. ii. p. 92, pl. 58. figs. 6, 7 (1887).

We possess a male from the interior of Colombia, and Mr. Godman's collection contains another from Tapajos obtained by Bates.

THECLA CEROMIA.

Thecla ceromia Hew. Ill. Diur. Lep. p. 185, pl. 74. figs. 573, 574 (1877).

Thecla suada Hew. ibid. p. 207, pl. 82. figs. 691, 692 (1878).

I quite agree with Hewitson that both these names refer to the same insect. The types are more alike than his figures.

THECLA BADACA.

Thecla badaca Hew. Descr. Lycænidæ, p. 12 (1868), ♂; Ill. Diur. Lep. p. 184, pl. 73. figs. 569, 570 (1877).

Thecla collucia Hew. ibid. p. 186, pl. 74. figs. 577, 578 (1877), ♀.

An examination of the types leaves no doubt that these names refer to the sexes of the same species. The figures are rather highly coloured, and in that of the female the orange crown to the caudal spot is omitted.

THECLA OPACITAS, sp. n.

Male. Upper side closely allied to *T. ceromia* Hew., but discal areas of both wings slightly cupreous. Under side much as in *T. ceromia*; black anal angular spots on hind wing prominent, and ultramedian band on hind wing more orange and wider. The extreme edge of the costa, as also the collar and the space between the eyes, is cupreous. Palpi black, with a few whitish hairs; terminal joint black.

Expanse $1\frac{2}{5}$ inch.

Hab. Mexico: Atoyac, Vera Cruz, in May (*H. H. Smith*).

Type, Mus. Godman.

This insect may prove to be a form of *T. ceromia* Hew., but at present it appears sufficiently distinct to require a name.

THECLA CANUS, sp. n.

Male. Upper side: allied to *T. ceromia* Hew., but discal areas of both wings distinctly cupreous. Under side much as in *T. ceromia*, but ground-colour paler and more olivaceous, and ultramedian band on hind wing pale orange and wider and marginal red spot more lunular and confined between lower median nervules. Palpi pure white, upper side of terminal joint only black.

Expanse $1\frac{1}{5}$ inch.

Hab. Mexico: Chilpancingo, Guerrero, 4600 feet, June (*H. H. Smith*). Amazons: Santarem (*Bates*). Mus. Godman & Mus. Brit.

Type, Mus. Godman.

The white palpi of this insect, which appears to have a wide range, together with the cupreous areas on the upper side, seem to distinguish it from its allies.

THECLA NUBES, sp. n.

Male. Upper side blackish brown with discal areas of fore wing cupreous. Basal areas of hind wing thickly clothed with cupreous hairs. Lobe orange. Cilia concolorous with wings and supporting long white hairs at the anal angle. Under side uniform pale olivaceous brown with an ultramedian linear orange band common to both wings, outwardly bordered by a fine black line and again by a pure white line and showing more prominently on the hind wing. A submarginal row of shades also common to both wings, inwardly bordered with whitish shades. A dark anteciliary line, black towards anal angle of hind wing, where it is inwardly bordered by a pure white line. Lobe black, crowned by an orange dash. Marginal space between submedian and lower median nervure black, thickly dusted with white scales. A small black marginal spot between the lower median nervules broadly crowned with orange. Legs white with black spots. Palpi white, with the upper side of the terminal joint only black. Eyes surrounded with pure white scales. Head blackish brown with a central frontal cupreous line; collar and costal edge of fore wing bright cupreous.

Female. Upper side uniform dull greyish brown; cilia pale grey. Lobe orange. Hind wing with an anteciliary black line inwardly bordered by a white line towards anal angle. Two dark marginal patches placed between the nervules above the lobe. Under side as in male but paler, and orange band on hind wing broader.

Expanse, ♂ $1\frac{1}{10}$, ♀ 1–$1\frac{1}{10}$ inch.

Hab. Tobago I. (Trinidad).

Types, Mus. Hope, Oxford.

Captured at Cocoa Wattie on April 7th, and at Scarborough on April 4th, by Dr. G. B. Longstaff, and by him presented to the Hope Museum. Two specimens Mus. Druce kindly presented by the captor.

This little insect, which I cannot discover to have been described, seems to be near the preceding *T. canus*, but it is smaller, the ground-colour above is blacker, and on the under side more olivaceous, and the ultramedian bands on both wings appear to be nearer to the margins. The hind wing also appears to be less produced anally.

THECLA POLITUS, sp. n. (Plate XXXVI. figs. 22 ♂, 23 ♀.)

Male. Upper side uniform dull brown; lobe dark orange. Under side much like that of *T. sangala* Hew. (*autoclea* Hew.), but large red patch on hind wing between lower median nervules placed closer to the margin.

Female. Upper side: fore wing uniform dull brown, slightly bluish along inner margin; hind wing pale lavender-blue, with the costa, apex, and outer margin rather narrowly brown. Under side as in male.

Expanse, ♂ $1\frac{1}{10}$, ♀ $1\frac{1}{10}$–$1\frac{1}{5}$ inch.

Hab. Guatemala, San Geronimo (*Champion*), 3000 feet. British Guiana, Essequibo River (*H. Whitely*). Interior of Colombia (*Wheeler*). Amazons; Tapajos, Santarem, and Ega (*Bates & H. H. Smith*) (Mus. G. & S.). Corumba, Brazil (*H. H. Smith*), April. Caparo, Trinidad (*Birch*) (Mus. Druce).

Types, Mus. Godman. The type specimens are from Santarem.

Of the twenty-four specimens before me only one is a male. Some females appear to have the outer margin of the fore wing straighter and the apex more pointed, which fact would lead one to suppose that they were males, but a closer examination proves them to be females.

The female here described has been identified by Dr. Butler in the British Museum Collection as *T. beon* Cr.; but the original description and figure are not clear enough to confirm this, and *T. beon* as now understood belongs to another section of the genus.

In *T. politus* the under side of the hind wing is always without the red spot near the anal margin beyond the white band.

Bates identified the female as that of *T. sangala* Hew., but did not identify the male, as may be seen from his specimens now in Mr. Godman's collection. Both sexes of *T. sangala* are brown and are so described by Hewitson.

THECLA SERAPIO.

Thecla serapio Godm. & Salv., B. C.-A., Lep. Rhop. vol. ii. p. 93, pl. 58. figs. 8, 9 (1887).

This insect is very closely allied to the Brazilian *T. azuba* Hew., Ill. Diur. Lep. p. 154, pl. 71. figs. 408, 409 (1874), which it closely resembles on the upper side, and differs only on the under side in the discal band on the hind wing being less inclined to break into spots.

THECLA LEMNOS.

Thecla lemnos H. H. Druce, Ent. Mo. Mag. vol. xxvi. p. 152 (1890).

Hab. Interior of Colombia (*J. Carder*).

Type, Mus. Druce.

Nearly allied to the preceding, but the blue area on the hind wing spreads well over the cell, and on the under side the median bands are much more irregular and more linear.

THECLA BASALIDES.

Tmolus basalides Hübn. Exot. Schmett. figs. 977, 978 (1837).

Thecla basalides Hew. Ill. Diur. Lep., Lycænidæ, p. 156, pl. 61. figs. 412–415.

Thecla basalides Godm. & Salv. B. C.-A., Lep. Rhop. vol. ii. p. 93 (1887).

Thecla ziba Hew. l. c. p. 153, pl. 61. figs. 404, 405.

The male usually has a red spot between the tails of hind wing above. Dr. Butler has identified this species as *T. echion* Linn. On examining the type of *T. ziba* I can find nothing to distinguish it from *T. basalides*.

Hewitson records *T. ziba* from Guatemala, but Messrs. Godman and Salvin do not mention it.

THECLA VETERATOR, sp. n. (Plate XXXVI. fig. 25.)

Male. Upper side: fore wing dull black; basal half of inner margin pale violaceous blue, extending upwards to the median nervure. A large dull brand occupying the outer half of the cell, and but slightly darker than the rest of the wing. Hind wing: pale violaceous blue with the costal margin and apex broadly dull black; anal fold pale grey. A black marginal spot between lower median nervules, and a pale yellow spot in the lobe. Cilia of anal half white with an anteciliary dark line, of apical half blackish. Under side much like that of *T. yojoa* Reakt.*, but with the white shades less prominent, and without the conspicuous white mark closing the cell of the fore wing and the white shades between the ultramedian band and the base in the hind wing.

Expanse $1\frac{3}{10}$ inch.

Hab. Paraguay.

Type, Mus. Brit. (Crowley Bequest).

Although I have compared this species with *T. yojoa*, it is possibly not very nearly allied, as the appearance of the brand, which in *T. yojoa* is more like a patch of darker scales, is quite different. We also possess a worn specimen from the same locality in which the brand has become much more prominent.

THECLA BUBASTUS.

Papilio bubastus Cr. Pap. Exot. iv. pl. 332. figs. G, H.

Thecla salona Hew. Descr. Lycænidæ, p. 31 (1868); Ill. Diur. Lep., Lyc. p. 159, pl. 63. figs. 429, 430 (1874).

Hab. Guiana, Venezuela, Amazons, Brazil, Paraguay, St. Vincent, Dominica, Grenada.

This is the tailless form of *T. eurytulus*.

I have no doubt, despite the fact that Cramer states his insect is from the Cape of Good Hope, that his figure represents a female of this common S. American *Thecla*. *T. salona* Hew. ♂ is described and figured without a tail, but of the four specimens in his collection now placed under his name, two are females without tails (1 Venezuela, 1 Brazil), whilst the two males are tailed.

I have before me about 150 specimens of the two forms, from some localities a long series, but in no single instance can I find any evidence of the two forms inhabiting the same locality.

Dr. Butler records *bubastus* Cr. from E. Central Africa (P. Z. S. 1893, p. 660), but I can find no specimens so labelled now in the British Museum. It is noteworthy that those

* *Thecla yojoa* Reakt. Proc. Ac. Phil. 1866, p. 339.

inhabiting the Greater Antilles are the tailed forms (*T. eurytulus*), and those from the Lesser Antilles are the tailless form (*T. bubastus*).

In Peru it appears to be replaced by the closely allied *T. sapota* Hew., also tailless.

THECLA EURYTULUS.

Tmolus eurytulus Hübn. Samml. Exot. Schmett. vol. ii. pl. 90 (1816–1841).

Thecla cybira Hew. Ill. Diur. Lep., Lyc. p. 161, pl. 73. figs. 435, 436 (1874).

Hab. Southern States of N. America. Mexico, Guatemala, Costa Rica, Panama, Haiti, Cuba, Jamaica, Bahamas.

This species has a distinct tail arising from the lower median nervule on the hind wing.

It extends southwards to Costa Rica, but we have no record of it from Colombia; and from Venezuela and Guiana, all through the Amazon region and Brazil to Paraguay, it is replaced by a tailless form, *T. bubastus* Cr.

American entomologists use the name *columella* Fab. for this species, but the Fabrician type being lost, and the description quite inadequate, I prefer to use Hübner's name. Further synonyms will be found in Lists of North American Butterflies.

On examining Hewitson's type of *T. cybira* I can find no points of distinction.

In a large series before me I find that the tails are least developed in specimens from Texas, and longest in those from the Bahamas.

This insect was taken by Grote as the type of his genus *Callicista*, and in Scudder's Butt. East. United States & Canada, p. 1819, the possession of the tail is given as a generic character.

THECLA ARGONA.

Thecla argona Hew. Ill. Diur. Lep., Lyc. p. 162, pl. 63. figs. 441, 442 (1874).

Thecla rana Schaus, P. U.S. Nat. Mus. vol. xxiv. p. 414 (1902).

Hab. Uruguay (*Hew.*); Corrientes (*Perrens*); Cordova and Buenos Ayres, Argentine Rep. (*White & Reeve*) (Mus. Godman & Druce); Paraguay (*Mus. Druce*); Rio Grande and Castro, Parana, Brazil (*Mus. Druce*).

Mr. Schaus has placed a specimen of *T. rana* in the British Museum, and we have a series from the same locality collected by Mr. E. D. Jones, but I can find no points which, in my opinion, make it worthy of distinction.

The dark spot at the end of the cell of the fore wing, described by Hewitson, often becomes more distinct in worn specimens, and in some that are quite fresh is scarcely apparent. The orange abdomen is also not a constant character, and in our series is to be found of various shades from grey to yellow.

THECLA TUCUMANA, sp. n. (Plate XXXVI. fig. 26.)

Allied to *T. americensis* Blanch.*

Upper side differs in anal half of hind wing from base to outer margin being pale violaceous blue, supporting three black marginal spots between the nervules. Under side: spots and markings much as in *T. americensis*, but the whole of the hind wing and the costal margin of the fore wing thickly mottled with dark brown and grey scales, thus rendering the markings very indistinct.

Expanse $1\frac{1}{10}$ inch.

Hab. Tucuman, Argentine Republic (*W. Reeve*).

Type, Mus. Druce.

I cannot determine the sex of the specimen described, but I believe it to be a female.

THECLA CYDIA.

Thecla cydia Hew. Ill. Diur. Lep., Lyc. p. 160, pl. 63. figs. 433, 434 (1874).

This insect is very close to *T. cestri* Reakt., and like it is tailless. The male, however, differs from that sex of *T. cestri* in the hind wing above being blue, as in the female. It is also a much smaller insect. We possess several specimens from Paraguay, and it is also in Mr. Godman's collection from the same locality (*W. Perrens*).

THECLA ARCULA, sp. n. (Plate XXXVI. fig. 27.)

Male. Upper side: fore wing purplish black, browner towards outer margin; a large dark brand occupying the whole of the cell excepting the extreme base. Hind wing: costal half dark purplish brown, anal half from base to outer margin dark violaceous blue, the blue running upwards along the margin to the apex. Anal fold pale brown. Cilia of both wings dark brown. Under side much like that of *T. sapota* Hew.†, but ground-colour dark purplish brown. Fore wing with a clearly defined whitish mark closing the cell and with the ultramedian band more linear and straighter. Hind wing with an orange spot at the anal angle, and an orange lunule crowning the marginal black spot between the lower median nervules.

Expanse $1\frac{1}{10}$ inch.

Hab. Tucuman, Argentine Republic (*W. Reeve*); Paraguay (*B.M.*, *Crowley Bequest*).

Type, Mus. Druce.

Four males not showing any variation.

Like *T. sapota* in the total absence of tails, but the brand is quite different, being in that species merely a small patch at the end of the cell.

* *Thecla americensis* Blanch. Gay's Fauna Chili. vii. p. 38.

† *Thecla sapota* Hew. Ill. Diur. Lep. p. 203, pl. 71. figs. 668, 669 (1877).

THECLA FAUNALIA.

Thecla faunalia Hew. Descr. of Lycænidæ, p. 31 (1868); Ill. Diur. Lep., Lyc. p. 161, pl. 63. figs. 437, 438 (1874).

Thecla deborrei Capr. Ann. Soc. Ent. Belg. xvii. p. 17, pl. i. fig. 4 (1874).

Mr. Godman's collection contains a female from Venta de Zopilote, Guerrero, Mexico (2800 feet), captured in October by H. H. Smith, which is certainly referable to this species, but is larger than specimens from the Amazon regions and Venezuela.

Capronier has given an excellent figure (♀) of this species from a Brazilian specimen.

THECLA THIUS.

Thyreus thius Hübn. Zutr. Ex. Schmett. figs. 743, 744 (1832).

Thecla agra Hew. Ill. Diur. Lep., Lyc. p. 147, pl. 58. figs. 369, 370; Godm. & Salv. B. C.-A., Rhop. ii. p. 97 (1887).

Thecla infrequens Weeks, Ent. News Phil. xii. (1901); Ill. Diur. Lep. p. 37, pl. v. fig. 3 (1905).

Hewitson apparently recognised, although he does not seem to have published the fact, that his name *agra* was a synonym, as the specimens in his collection stand under the name *thius*; neither one of them being marked *agra*. No mention of *T. agra* is made by Mr. Kirby in his Catalogue of the Hewitson Collection. Hübner's figure is a good one, and the species should be easily made out. Mr. Weeks's excellent figure shows that he is dealing with this well-known species. The sex is not stated, but it appears to represent a female.

THECLA TEGÆA.

Thecla tegœa Hew. Descr. of *Thecla*, p. 2; Ill. Diur. Lep., Lyc. p. 131, pl. 54. figs. 308, 309 (1869).

Hab. British Guiana (*Whitely*) (Mus. Druce); Brazil, Chapada Campo (*H. H. Smith*) (Mus. Godman).

Described by Hewitson from an unknown locality. The female differs from the male only in the absence of the dark patch in the cell of the fore wing, and in the marginal orange border on the hind wing being narrower.

THECLA DUMENILII.

Polyommatus dumenilii Godt. Enc. Méth. ix. p. 677 (1823).

Thecla argiva Hew. Ill. Diur. Lep., Lyc. p. 208, pl. 83. figs. 700–702.

Thecla argiva, var. *obscura* Staud. Exot. Schmett. p. 286, pl. 97 (1888).

Mr. Godman has specimens from Colombia obtained by Wheeler and F. Simons.

It is a variable species on the under side, some examples being very faintly marked and lacking the black spot on the costa of hind wing, and also that between the nervules near the anal angle.

Theclopsis.

Theclopsis Godm. & Salv., B. C.-A., Lep. Rhop. vol. ii. p. 99 (1887).

Type, *Thecla lebena* Hew.

Theclopsis eryx.

Papilio eryx Cr. Pap. Exot. vol. ii. pl. 143. fig. D (1779).

Bithys lydus Hübn. Verz. bek. Schmett. p. 75 (1816).

Papilio ingæ Sepp, Surin. Vlind. vol. i. pl. xvii. (1848).

Thecla lebena Hew. Descr. Lyc. p. 9 (1868); Ill. Diur. Lep., Lyc. p. 127, pl. 51. figs. 266, 267 (1869).

Cramer's name for this insect appears to be the oldest, and now that Messrs. Godman and Salvin have taken it as the type of a new genus, *lydus* Hübn. becomes unnecessary.

On examining a large series ranging from British Guiana to Pará, I can find no characters to distinguish *ingæ* and *lebena* from *eryx*. Cramer's figure is not a good one, but I think that without doubt it represents the insect which has usually been referred to as *T. lebena*. It is browner than the common type from Surinam, but I have before me specimens from Pará which in this respect closely resemble it. The red areas near the anal angle on under side of hind wing are more extensive in southern specimens than in those from Guiana, although Sepp's figures show them very distinctly. This author evidently mistook the sexes, as a reference to the plate will show. I have never seen the female.

Mr. Godman has specimens from Ecuador, Peru, and Bolivia, and these have the blue on the upper side more extensive, especially on the hind wing, which has but a narrow black margin; but I can detect no other difference.

Theclopsis cæus.

Theclopsis cæus Godm. & Salv. B. C.-A., Lep. Rhop. vol. ii. p. 101, pl. 58. figs. 24, 25 (1887).

It is doubtful if this is distinct from *T. demea* Hew. (Ill. Diur. Lep., Lyc. p. 180, pl. 70. figs. 533, 534, 1874), as I find a number of specimens from the interior of Colombia and from Venezuela have the crescent-shaped brand, but are without the patch of shining scales on the fore wing below. For the present, however, I prefer to keep them apart.

I have seen no females of either form.

EXPLANATION OF THE PLATES.

Plate XXXI.

Fig.
1. *Thecla candidus* ♂, nov., p. 571.
2. „ „ ♀, nov., p. 571.
3. „ *sumptuosa* ♂, nov., p. 571.
4. „ *splendor* ♀, nov., p. 570.
5. „ *ornatrix* ♂, nov., p. 572.

Fig.
6. *Thecla floralia* ♂, nov., p. 572.
7. „ *trochus* ♂, nov., p. 573.
8. „ *photeinos* ♂, nov., p. 573.
9. „ *eronos* ♂, H. H. Druce, p. 573.

Plate XXXII.

Fig.
1. *Thecla crines* ♂, nov., p. 573.
2. „ „ ♀, nov., p. 574.
3. „ *barba* ♂, nov., p. 575.
4. „ *numen* ♂, nov., p. 574.
5. „ „ ♀, nov., p. 574.

Fig.
6. *Thecla amplitudo* ♂, nov., p. 575.
7. „ *ion* ♂, H. H. Druce, p. 576.
8. „ *comæ* ♂, nov., p. 576.
9. „ „ ♀, nov., p. 576.
10. „ *chlamydem* ♂, nov., p. 577.

Plate XXXIII.

Fig.
1. *Thecla candor* ♂, nov., p. 578.
2. „ *anna* ♂, nov., p. 577.
3. „ *tyrrius* ♂, nov., p. 578.
4. „ *hybla* ♂, nov., p. 578.
5. „ *exiguus* ♂, nov., p. 580.
6. „ *castimonia* ♂, nov., p. 580.
7. „ *melleus* ♂, nov., p. 580.
8. „ *floreus* ♂, nov., p. 581.

Fig.
9. *Thecla gemma* ♂, nov., p. 581.
10. „ *porthura* ♂, nov., p. 581.
11. „ *color* ♂, nov., p. 582.
12. „ *ravus* ♂, nov., p. 582.
13. „ *amplus* ♂, nov., p. 582.
14. „ *cydonia* ♂, H. H. Druce, p. 583.
15. „ *flosculus* ♂, nov., p. 583.

Plate XXXIV.

Fig.
1. *Thecla stiktos* ♂, H. H. Druce, p. 584.
2. „ *stigmatos* ♂, H. H. Druce, p. 584.
3. „ *chlamys* ♂, nov., p. 584.
4. „ *buccina* ♂, nov., p. 585.
5. „ *nitor* ♂, nov., p. 585.
6. „ *murex* ♂, nov., p. 585.
7. „ *pharus* ♂, nov., p. 586.
8. „ *radiatio* ♂, nov., p. 586.
9. „ *jactator* ♂, nov., p. 587.

Fig.
10. *Thecla munditia* ♂, nov., p. 586.
11. „ „ ♀, nov., p. 586.
12. „ *obelus* ♂, nov., p. 588.
13. „ *literatus* ♂, nov., p. 588.
14. „ „ ♀, nov., p. 588.
15. „ *cauter* ♂, nov., p. 589.
16. „ *torris* ♂, nov., p. 587.
17. „ *nota* ♂, nov., p. 592.
18. „ *buris* ♂, nov., p. 590.
19. „ *caltha* ♂, nov., p. 591.
20. „ *purpura* ♂, nov., p. 592.

Plate XXXV.

Fig.
1. *Thecla nivepunctata* ♂, nov., p. 592.
2. „ *porphyreticus* ♂, nov., p. 593.
3. „ *deliciæ* ♂, nov., p. 595.
4. „ *porphyritis* ♂, nov., p. 595.
5. „ *tyriam* ♂, nov., p. 595.
6. „ *ostrinus* ♂, nov., p. 596.
7. „ *purpurantes* ♂, nov., p. 597.

Fig.
8. *Thecla phoster* ♂, nov., p. 597.
9. „ *uterkudante* ♂, nov., p. 596.
10. „ *mulsus* ♂, nov., p. 598.
11. „ *pulchritudo* ♂, nov., p. 597.
12. „ *conchylium* ♂, nov., p. 598.
13. „ *smaragdus* ♂, nov., p. 599.
14. „ *levis* ♂, nov., p. 598.
15. „ *collustra* ♂, nov., p. 600.

Plate XXXVI.

Fig.
1. *Thecla gentiana* ♂, nov., p. 601.
2. „ *purpuriticus* ♂, nov., p. 601.
3. „ *venustus* ♂, nov., p. 602.
4. „ „ ♀, nov., p. 602.
5. „ *lenitas* ♂, nov., p. 603.
6. „ *labes* ♂, nov., p. 602.
7. „ *upupa* ♂, nov., p. 605.
8. „ *canitus* ♂, nov., p. 604.
9. „ *picus* ♀, nov., p. 606.
10. „ *clepsydra* ♂, nov., p. 607.
11. „ *callao* ♂, nov., p. 611.
12. „ *cupa* ♂, nov., p. 612.
13. „ *cos* ♂, nov., p. 613.

Fig.
14. *Thecla oleris* ♂, nov., p. 614.
15. „ *photismos* ♂, nov., p. 615.
16. „ *mantica* ♂, nov., p. 616.
17. „ „ ♀, nov., p. 616.
18. „ *cæspes* ♀, nov., p. 614.
19. „ *cæsaries* ♂, nov., p. 617.
20. „ *emendatus* ♂, nov., p. 619.
21. „ *vena* ♂, nov., p. 620.
22. „ *politus* ♂, nov., p. 625.
23. „ „ ♀, nov., p. 625.
24. „ *verbenaca* ♂, nov., p. 622.
25. „ *veterator* ♂, nov., p. 627.
26. „ *tucumana*, nov., p. 629.
27. „ *arcula* ♂, nov., p. 629.

4. Descriptions of the Teleostean Fish *Velifer hypselopterus* and of a new Species of the Genus *Velifer*. By C. Tate Regan, M.A., F.Z.S.

[Received May 28, 1907.]

In the 'Fauna Japonica' Schlegel described and figured a remarkable Teleostean fish to which he gave the name *Velifer*, and for which Bleeker subsequently proposed the specific appellation *hypselopterus*.

There are three examples of this species in the British Museum collection, measuring nearly 200 mm. in total length; their principal external characteristics are given in the following description.

Velifer hypselopterus.

Velifer Schleg. Faun. Japon., Poiss. p. 312, Suppl. Pl. A (1850).

Velifer hypselopterus Bleek. Verh. Ak. Amst. xviii. 1879, "Japan," p. 16; Jord. & Snyd. Annot. Zool. Japon. iii. 1901, p. 69.

Body ovate, strongly compressed, covered with rather small, thin, not very adherent cycloid scales, of which there are nearly 70 in a longitudinal series; lateral line complete, nearly straight. Head scaly, except the snout; none of the bones of the head serrated; mouth rather small, toothless, very protractile; maxillary completely exposed; two nostrils on each side; eye lateral, of moderate size, its diameter about $\frac{3}{4}$ the length of snout and $\frac{1}{4}$ the length of head. Gill-membranes narrowly joined to the isthmus; 6 branchiostegals; 4 gills, a slit behind the fourth; pseudobranchiæ large. Dorsal fin extending nearly the whole length of the back, with 2 spines and 32 or 33 articulated rays, of which the first 22 to 24 are simple, the last 8 to 10 branched; anal fin long, without spines, of 24 or 25 rays, 15 or 16 simple and 8 to 10 branched; dorsal and anal fins greatly elevated anteriorly, each depressible within a scaly sheath. Pectoral of moderate length, with sub-horizontal base on the level of the suboperculum, asymmetrical, with 15 or 16 rays, the upper the longest. Ventrals rather elongate, below the pectorals, close together, of 8 articulated rays, the inner 7 branched; a well-developed scaly axillary process. Caudal forked. Silvery, back greenish; fins dusky, the dorsal and anal with oblique stripes or series of spots.

Hab. Japan.

A second species is represented in the British Museum, viz.:—

Velifer multiradiatus, sp. n.

Dorsal fin of 41 rays, of which about the last 20 are branched. Anal fin of 33 rays, of which about the last 16 are branched.

Ventral fins apparently 9-rayed. A dark spot on the back, extending on to the base of the anterior branched rays of the dorsal fin. In other respects apparently very similar to *V. hypselopterus*.

Hab. North-west coast of Australia.

A single rather badly preserved specimen, 55 mm. in total length.

5. On the Anatomy, Classification, and Systematic Position of the Teleostean Fishes of the Suborder *Allotriognathi*. By C. Tate Regan, M.A., F.Z.S.

[Received May 21, 1907.]

(Text-figures 166–171.)

1. *Descriptions of Skeletons.*

The fishes of the families Lamprididæ, Veliferidæ, Trachypteridæ, and Lophotidæ have not usually been placed together by systematists, but it is the object of the present communication to show that they form a natural group and may be regarded as comprising a suborder of the order Teleostei. The reasons for this will be apparent when the skeletal anatomy of the various types has been described.

Lamprididæ.

This family comprises a single species, *Lampris luna*, of which I have examined a skeleton. This is not in very good condition, and I am indebted to Messrs. W. and I. Sherrin for the opportunity of ascertaining the exact limits of the supraoccipital and orbitosphenoid bones in a fresh specimen.

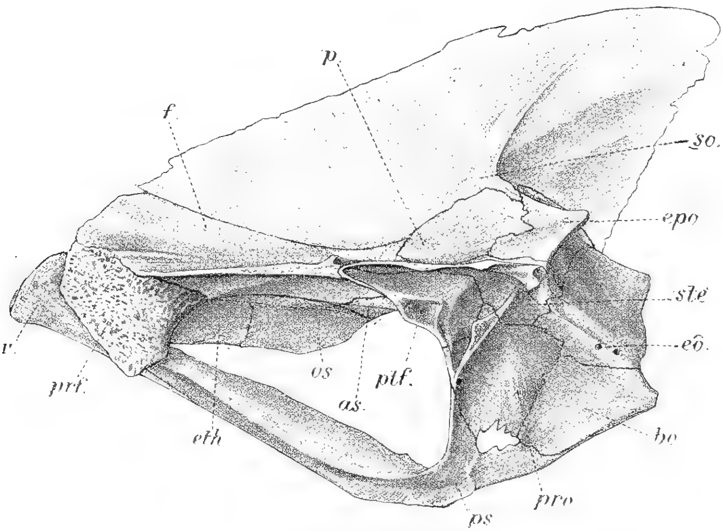
The cranium (text-fig. 161) does not differ very essentially from that of the Berycoid fishes which have been described and figured by Starks*, although the great development of the occipital crest, which extends to the anterior extremity of the frontals, gives it a different appearance. The parietals and epiotics are separated by the supraoccipital, the exoccipitals bound the *foramen magnum*, and the basisphenoid and orbitosphenoid are present. Cranial features of importance are the absence of an opisthotic (present and well-developed in all Berycoids), the extension forward of the supratemporal (pterotic) to the frontal, so that the postfrontal (sphenotic) does not appear on the upper surface, the position of the mesethmoid, the anterior part of which is embraced by the præfrontals but which extends backwards and meets the orbitosphenoid, and the structure of the vomer, which has a pair of grooves separated by a median longitudinal keel on its antero-superior surface.

The maxillary has an inner posterior process which underlies the similar process of the præmaxillary and slides backwards and

* Proc. U.S. Nat. Mus. xxvii. 1904, pp. 601–619.

forwards in the groove at the side of the vomerine keel. This is quite a different arrangement to that usually found in fishes with protractile mouths. In the Berycoids the maxillary is articulated proximally to the vomer and has a ligamentous attachment to an anterior process of the palatine, so that only the distal end moves forward when the præmaxillaries are protruded. In *Lampris*, however, it is the maxillaries which are protractile and which carry the præmaxillaries forward.

Text-fig. 166.



Cranium of *Lampris luna*.

v., vomer; *f.*, frontal; *p.*, parietal; *so.*, supraoccipital; *epo.*, epiotic; *ste.*, supratemporal (pterotic); *eo.*, exoccipital; *bo.*, basioccipital; *ps.*, parasphenoid; *pro.*, prootic; *ptf.*, postfrontal (sphenotic); *as.*, alisphenoid; *os.*, orbitosphenoid; *eth.*, ethmoid; *prf.*, prefrontal.

There is no supramaxillary bone. Except for the absence of a maxillary process of the palatine, the bones of the hyo-palatine and opercular series exhibit no departure from the normal type. The suborbitals do not form a subocular shelf. The branchiostegal rays are six in number.

There are 46 vertebræ, 21 præcaudals and 25 caudals. The centra are solid and co-ossified with the arches. The first centrum is convex anteriorly, fitting the concavity formed by the basi- and ex-occipitals. There are no parapophyses and the long ribs are sessile. The pectoral arch has been figured by Boulenger*; the forked post-temporal is attached to the epiotic above and to the exoccipital below; the coracoids are greatly expanded; the rays of

* Ann. Mag. Nat. Hist. (7) x. 1902, pp. 147–152, fig.

the pectoral fin are attached to the scapula and to three pterygials, two of which are inserted on the scapula and one on the coracoid; the post-clavicle is long and slender and consists of a single piece.

The pelvis comprises a pair of erect subtriangular bony plates which are attached to the coracoids, each having a groove on the anterior part of its outer surface for the reception of the posterior edge of the coracoid.

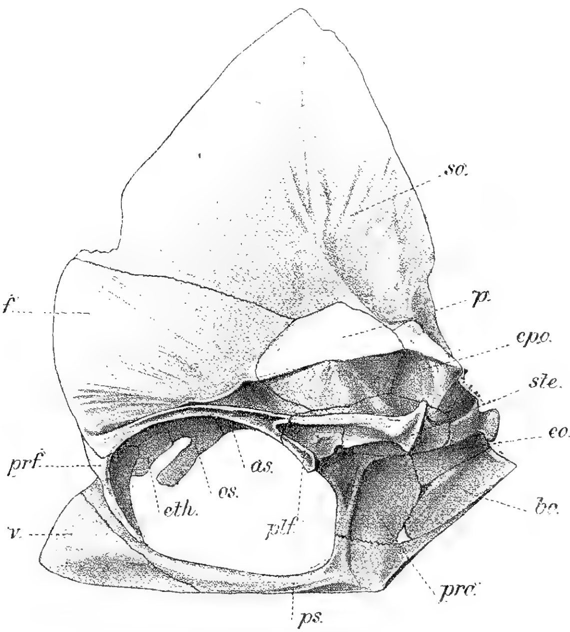
Veliferidæ.

I have prepared the skeleton of an example of *Velifer hypselopterus.*

As will be seen from the accompanying figures (text-figs. 166, 167) the cranium bears a striking resemblance to that of *Lampris* in general form, and it comprises the same bones which have very nearly the same relation to each other. The important differences are the following:—

There is a considerable amount of cartilage in the orbital and ethmoidal regions, and there is a large anterior cavity the floor of

Text-fig. 167.



Cranium of *Velifer hypselopterus.*
Lettering as in text-fig. 166.

which is formed by cartilage and by the orbitosphenoid, mesethmoid, and præfrontal bones, and the sides and roof by the præfrontals and frontals.

The mesethmoid is entirely posterior to the præfrontals. In front of the mesethmoid the cartilaginous floor of the anterior cranial chamber bears a median keel, corresponding to the keel of the vomer in *Lampris*. In *Velifer*, however, the vomer does not ossify through, but only sends up a pair of wings which flank the præethmoid cartilage.

The mouth (text-fig. 170, p. 640) is more protractile than in *Lampris*, but the præmaxillaries and maxillaries are arranged on the same plan. The hyo-palatine, orbital, and opercular bones are as in *Lampris*.

The vertebral column comprises 33 vertebræ, 16 præcaudals and 17 caudals; the ribs are attached to downwardly directed parapophyses; the first centrum is short and is convex anteriorly.

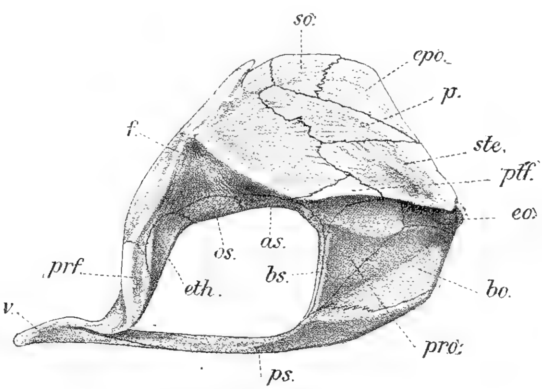
The pectoral arch differs from that of *Lampris* in that the coracoid is normal and the pterygials are 4 in number, the last in contact with the coracoid. As in *Lampris* the post-clavicle is simple and elongate.

The pelvic bones are a pair of erect subtriangular plates, with their apices imbedded in the ligamentous tissue between the coracoids.

Trachypteridæ.

The skeleton of *Trachypterus tænia* is feebly ossified, and the bones are very thin and light, almost papery. There is no occipital crest, and the epiotics meet behind the supraoccipital, but in all other essentials the cranium (text-fig. 168) agrees with that of *Velifer*.

Text-fig. 168.



Cranium of *Trachypterus tænia*.

Lettering as in text-fig. 166. *bs.*, basisphenoid.

Of the orbital bones only the præorbital is ossified. The maxillary and præmaxillary (text-fig. 169, p. 639) are on the same plan as in *Velifer*, but the former bone has the outer blade expanded and closely attached to the præmaxillary

The vertebral column comprises 90 vertebræ; the præcaudals have downwardly directed parapophyses; ribs appear to be absent. The pectoral arch differs from that of *Velifer* in that the post-temporal is simple and that the pectoral pterygials are 3 in number, two of which are inserted on the coracoid.

The pelvic bones resemble those of *Velifer* in structure and attachment, but have the posterior angle produced and embraced by the extremities of the post-clavicles.

The skeleton of *Regalecus* has been described by Parker * and Dunbar †. I have examined the large skeleton described by Parker, which is essentially similar to that of *Trachypterus*, differing in the absence of a basisphenoid and in the presence of some feeble ribs.

The post-frontal and pro-otic bones in *Regalecus* are situated as shown in the accompanying figure of *Trachypterus* (text-fig. 168, p. 637).

The descriptions of both Parker and Dunbar, who have determined the greater part of the pro-otic bone as opisthotic, are erroneous.

The pelvic bones in *Regalecus* are considerably larger than in *Trachypterus* and their anterior edges lie between the clavicles.

Lophotidæ.

I have examined a spirit specimen of *Lophotes cepedianus*. The moderately protractile mouth is similar in structure to that of *Trachypterus*; by depressing the large eye of one side I have been able to ascertain that an orbitosphenoid bone is present and that it is in contact with the mesethmoid, which is entirely posterior to the præfrontals; dissection of the base of the pectoral fin on one side shows that the relations of scapula, coracoid, and pterygials are as in *Trachypterus*.

For *Lophotes fiskii* Gthr. I propose the new generic name *Eumecichthys* ‡. The mouth is non-protractile, the posterior processes of the præmaxillaries having their extremities attached to the anterior face of the vomer, instead of sliding backwards and forwards on each side of a median longitudinal keel, as in *Lophotes*.

2. *Definition and Classification of the Suborder* Allotriognathi.

Suborder ALLOTRIOGNATHI.

Supraoccipital well-developed, separating the parietals; no opisthotic; an orbitosphenoid, anteriorly in contact with the mesethmoid, which is wholly or in part posterior to the præfrontals. Mouth typically protractile; maxillary with an outer

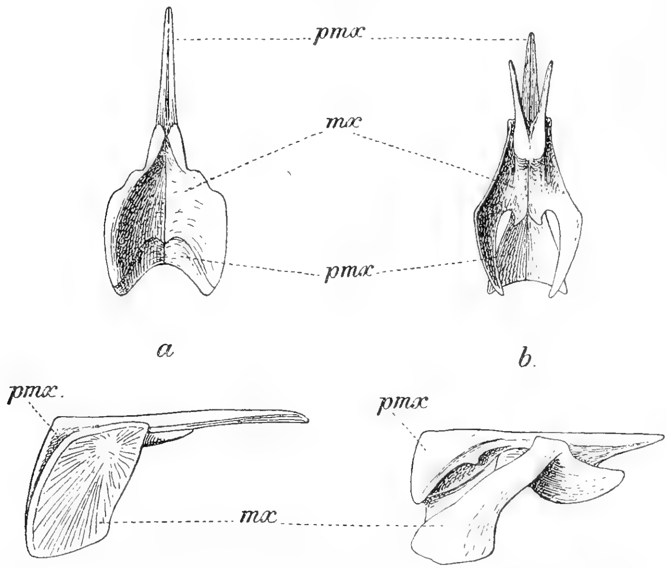
* Trans. Zool. Soc. xii. 1886, pp. 5–33, pls. ii.–vi.

† Proc. Zool. Soc. 1906, pp. 547–566, pls. xxxviii. & xxxix.

‡ Boulenger (Mar. Inv. S. Afr. i. 1902, p. 13) writes: "*Lophotes fiskii* differs very widely from the tropical form of the genus; its extremely elongate, ribbon-like form and the probable absence of an anal fin, to say nothing of the frontal crest and the absence of ventral fins, indicates, in my opinion, a distinct genus."

blade and with an inner posterior process which is connected with its fellow below the præmaxillary spines; maxillary processes typically sliding backwards and forwards on each side of a median keel on the vomer or on the præethmoid cartilage *; no supramaxillary; lower jaw composed of dentary, articulare and angulare. Palatine without an anterior process for attachment of the maxillary. Vertebral column of solid centra which are co-ossified with the arches. Gills pectinate. Pectoral arch attached to the cranium; no mesocoracoid; post-clavicle elongate, of a single piece. Air-bladder without pneumatic duct. Vertical fins without true

Text-fig. 169.



Præmaxillaries (*pmx.*) and maxillaries (*mx.*) of *Trachypterus tænia* (*a.*) and *Velifer hypselopterus* (*b.*), seen from below and from the side.

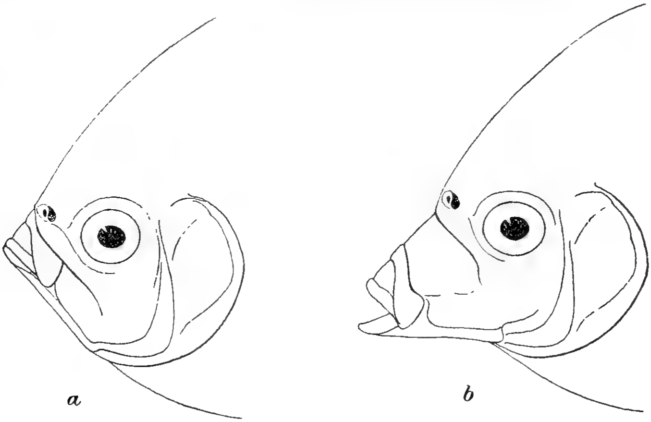
spines (except sometimes the first one or two rays of the dorsal); pectoral fin with horizontal or sub-horizontal base; ventral fins, if present, below or a little behind the pectorals, without spines; pelvis comprising a pair of erect subtriangular bony plates, inserted in the ligament between the coracoids and sometimes directly articulated with them.

In addition to the characters given in the diagnosis we may note that all the Allotriognathi have the head without spines or serrations, 6 branchiostegals, 4 gills, and well-developed pseudo-

* In the most specialised member of the group, the Lophotid *Eumecichthys*, the mouth is not protractile, and the posterior ends of the præmaxillary processes are attached to the anterior face of the vomer.

branchiæ. Teeth are usually feeble or absent, never strong, and the scales, if present, are thin and deciduous or reduced to scattered tubercles.

Text-fig. 170.



Head of *Velifer hypselopterus* with the mouth closed (*a*) and protruded (*b*).

Division 1. **Selenichthyes** (Boulenger).

Body deep, compressed; skeleton well-ossified; cranium without cartilage. No anterior cranial chamber; frontals normal, in contact below with the mesethmoid and orbitosphenoid; mesethmoid partly between and partly posterior to the præfrontals; epiotics separated by the supraoccipital. Vertebræ in moderate number (46); no parapophyses; ribs strong, sessile. Post-temporal forked; pectoral fin-rays inserted on the scapula and on 3 pterygials, one of which is in contact with the coracoid; pelvic bones articulated to the greatly expanded coracoids. Fins without spines, composed entirely of articulated rays; dorsal and anal fins long; ventral fins of 15 to 17 rays.

Family Lamprididæ. A single genus, *Lampris* Retzius.

Division 2. **Histichthyes.**

Body deep, strongly compressed; skeleton well-ossified, but the cranium with a considerable amount of cartilage. A large anterior cranial chamber, the walls of which are mainly formed by the frontals, the floor by cartilage containing the mesethmoid and orbitosphenoid ossifications; mesethmoid entirely posterior to the præfrontals; epiotics separated by the supraoccipital. Vertebræ in moderate number (33); ribs strong, attached to well-developed downwardly directed parapophyses. Post-temporal forked; pectoral fin-rays inserted on the scapula and on 4 pterygials, one of which is in contact with the coracoid, which is not expanded; pelvic bones not articulated to the coracoids. Fins composed of articulated rays, except the first two rays of the dorsal, which are spinous; dorsal and anal fins long; ventral fins of 8 or 9 rays.

Family VELIFERIDÆ. A single genus, *Velifer* Schleg.

Division 3. **Tæniosomi** (Gill).

Body elongate, strongly compressed; skeleton feebly ossified, the bones thin; cranium with a considerable amount of cartilage. An anterior cranial chamber or groove, the walls of which are mainly formed by the frontals, the floor by cartilage containing the mesethmoid and orbitosphenoid ossifications; mesethmoid entirely posterior to the præfrontals; epiotics meeting behind the supraoccipital. Vertebræ numerous (90 to 93); præcaudals with downwardly directed parapophyses; ribs feeble or absent, if present attached to the parapophyses. Post-temporal simple; pectoral fin-rays inserted on the scapula and on 3 pterygials, two or all of which are in contact with the coracoid; pelvic bones not articulated to the coracoid, but inserted in the ligamentous tissue between them. Fins composed of flexible, non-articulated rays (the first ray of the dorsal sometimes spinous); dorsal fin very long; anal short or absent; ventral fins, if present, of 1 to 9 rays.

Family 1. TRACHYPTERIDÆ.

Ventral fins present, close together, of 1 to 9 rays; no anal fin; vent about in the middle of the length of the fish.

Two genera, *Trachypterus* Gouan, and *Regalecus* Brünn.

Family 2. LOPHOTIDÆ.

Ventral fins, if present, small, of 5 or 6 rays, widely separated, inserted a little below and behind the pectorals; a short anal fin; vent posterior, just in front of the anal.

Two genera, *Lophotes* Giorna, and *Eumecichthys* Regan.

3. *Systematic Position of the* Allotriognathi.

The Allotriognathi and the Beryciformes are the only fishes which combine the presence of an orbitosphenoid with the absence of a mesocoracoid. The two groups agree also in having the ventral fins placed more or less anteriorly and often composed of a large number of rays (up to 17 in the Allotriognathi, up to 14 in the Beryciformes), and in being physoclistic (with the exception of *Beryx* and *Holocentrum*).

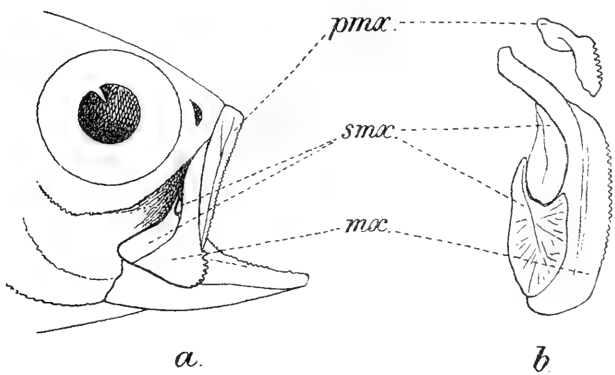
In cranial structure the Beryciformes differ from *Lampris* (which has the most generalised cranium of the Allotriognathi) only in being less specialised; *i. e.*, the opisthotic is well-developed, the maxillary carries 1 or 2 supramaxillaries, is normally articulated to the vomer and is attached to a process of the palatine. The pectoral arch of *Velifer* is identical with that of the Beryciformes.

Taking the Beryciformes in the most restricted sense, they include fishes without spines in the ventral fins and with the pelvic bones free from the pectoral arch (i. e., *Polymixia*), but all the living members of the group (if we omit *Stephanoberyx*, of which the anatomy is unknown) have the dorsal and anal fins preceded by spines. Except for this they are exactly fitted for giving rise to the Allotriognathi, and there can be little doubt that the latter had a Berycoid origin.

The origin of the Berycoid fishes themselves is another question. Smith Woodward and Boulenger place them at the base of the Acanthopterygian series, and adduce the persistence of the pneumatic duct (in *Holocentrum* and *Beryx*), the large number of rays in the ventral fins, and the abundance of the group in Cretaceous times as evidence of their generalisation. More recently Starks has shown that an orbitosphenoid bone is present in most Malacopterygii, all Ostariophysi and the Beryciformes, but not in the Haplomi or other higher groups.

I find that in most species of *Myripristis* (text-fig. 171 *a*) the maxillary is toothed and enters the gape when the mouth is widely opened, and that in the Polymixiidæ, Berycidæ, and Holocentridæ there are two supramaxillaries, which evidently correspond to those of the Clupeoid Fishes.

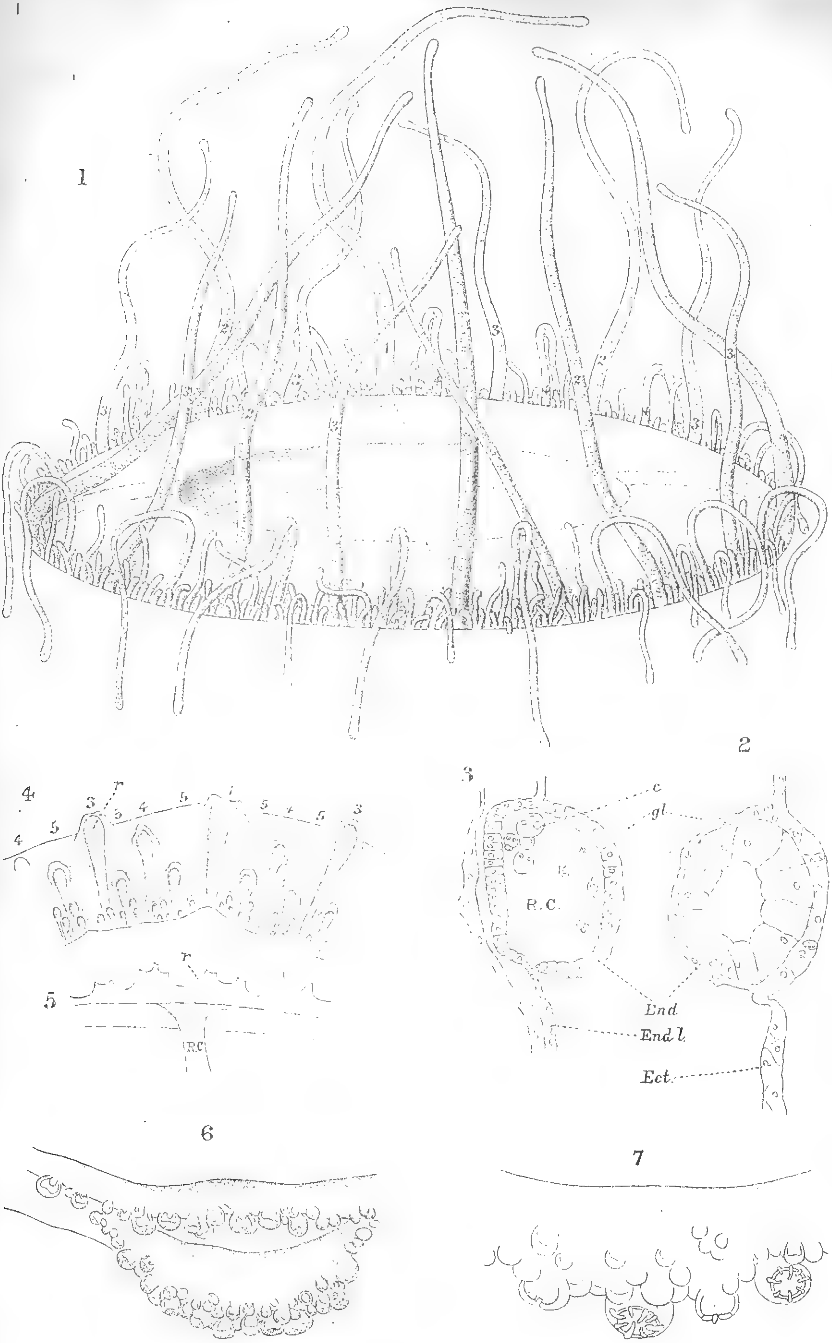
Text-fig. 171.



a. Anterior part of head of *Myripristis murdjan*.
b. Upper jaw of *Ctenothrissa radians* (after Smith Woodward).
pmx., præmaxillary; *mx*., maxillary; *smx*., supramaxillaries.

All these facts taken together lead me to believe that the Beryciformes may have evolved directly from Malacopterygii such as the Cretaceous *Ctenothrissa* (text-fig. 171 *b*) and *Pseudoberyx*, to which they bear a considerable resemblance.

A number of fishes have at times been associated with one or other of the families of Allotriognathi, and some of these must be discussed.



M. P. Parker lith. Parker & West imp.

LIMNOCNIDA TANGANICÆ.

The Lamprididæ, Veliferidæ, and Lophotidæ have at one time or another been supposed to be related to the Scombriform Acanthopterygians, but these are a much more specialised group, without an orbitosphenoid and typically with a spinous dorsal fin, the anal preceded by spines, the ventrals composed of a spine and 5 soft rays, and the pelvic bones directly attached to the clavicles.

Boulenger has placed *Lampris* near the Gastrosteidæ, on the ground of an interpretation of the elements of the pectoral arch which has not received acceptance, but these differ widely from it in their anatomy and seem probably to have originated from the Haplomi near the Cyprinodontidæ and Scombresocidæ.

Jordan has stated that the Eocene *Semiophorus* is related to *Lampris*. Dr. Smith Woodward very kindly looked at the specimens of the extinct genus in the British Museum with me, and it seems on the whole probable that *Semiophorus* is not related to *Lampris* and *Velifer*, but to *Platax*, near which genus Dr. Smith Woodward has placed it.

In *Semiophorus* the vertebræ are 24 in number, the dorsal fin is covered with small scales, the anal fin is preceded by 3 spines, and the outer ray of the ventral fin is a short spine. It is probable that the soft rays of the ventral fin are 5 in number and much branched, and not so numerous as would appear from the current representation of this fish.

The Tæniosomi were regarded by Dr. Gill as possibly derived from the same stock as the Pleuronectidæ; whilst Boulenger, on the ground of the large number of rays in the ventral fins, considered them as probably related to the Beryciformes.

The remarkable *Stylophorus* has usually been placed with or near the Trachypteridæ. The single known specimen is not in good enough condition for me to offer any suggestion as to its relationships.

6. Zoological Results of the Third Tanganyika Expedition, conducted by Dr. W. A. Cunnington, 1904–1905.—Report on *Limnocnida tanganicæ*; with a Note on the Subspecies from the Victoria Nyanza. By R. T. Günther, M.A., F.R.G.S., Fellow of Magdalen College, Oxford *.

[Received May 22, 1907.]

(Plate XXXVII. † & Text-figures 172–174.)

The collection of the jelly-fish of Lake Tanganyika made by Dr. Cunnington in 1904 and 1905 is the best which has yet been brought to this country. 78 individuals, some in several hitherto undescribed stages of development, were obtained from three localities at four different dates from September to February,

* Communicated by the Secretary.

† For explanation of the Plate, see p. 656.

and therefore from the close of the dry season until well on into the season of the great rains. The excellent state of preservation of the material is greatly to the credit of the collector, and has facilitated my investigation of some of the problems presented by this enigmatical creature. Some specimens were exhibited at the Meeting of the Society on March 6, 1906, a notice of the exhibit appearing in the P. Z. S. 1906, p. 179.

It has been known for some time that at certain seasons of the year, three types of individuals—males, females, and those which reproduce asexually by budding—occur in the lake at the same time. Mr. Moir's collection, the first to reach Europe, showed that all coexisted during April, May, and June. As one of the results of his first expedition in 1897, Mr. J. E. S. Moore found that early in March a few large specimens were reproducing by budding, and that this process was so rapid that in a few weeks the bays and open waters became filled with immense shoals which in June and July extended for miles and miles. At the same time, sexually mature individuals appeared. In his account of a second expedition in 1900, Moore asserts that in September and October, only sexual forms which showed no tendency to produce buds were to be captured in the lake. On this evidence Moore believed that he had discovered the relation of the life-cycle of *Limnocnida* to the wet and dry seasons—viz., reproduction by budding during the dry months, and sexual reproduction only during the wet winter months.

Dr. Cunnington's collections made during the wet season show that this theory cannot be upheld, for all contain asexual individuals exhibiting active bud-formation on their manubria, and these asexual individuals even outnumber the individuals with smooth manubria.

The collections are, moreover, characterised by the entire absence of any mature females; a fact which seems all the more remarkable, because in a small collection of *Limnocnida* from Victoria Nyanza which had been formed in August, and had been submitted to me for examination (p. 650) all the individuals were female.

Stated in a tabular form the present state of our knowledge regarding the seasonal distribution of *Limnocnida* is as follows:—

Dry Season.	March.	Few large budding medusæ (Moore, 1897).
	April. May. June.	♂, ♀ and budding medusæ coexist (Moir, 1893).
	June. July.	♂, ♀ and budding medusæ in shoals (Moore, 1897).
	August. September.	♂ and budding medusæ (Cunnington, 1904).
Season of Great Rains.	December.	♂ and budding medusæ. Many very young individuals. No ♀ individuals.
	February.	Old and young ♂ and budding medusæ (Cunnington, 1904).

We are therefore compelled to the view that the asexual method of reproduction is the most usual one in Lake Tanganyika throughout the year, and that the sexual method may be confined to a definite season; the earliest date at which it has been observed is in the month of May, and we have as yet no evidence for its continuance beyond the month of July.

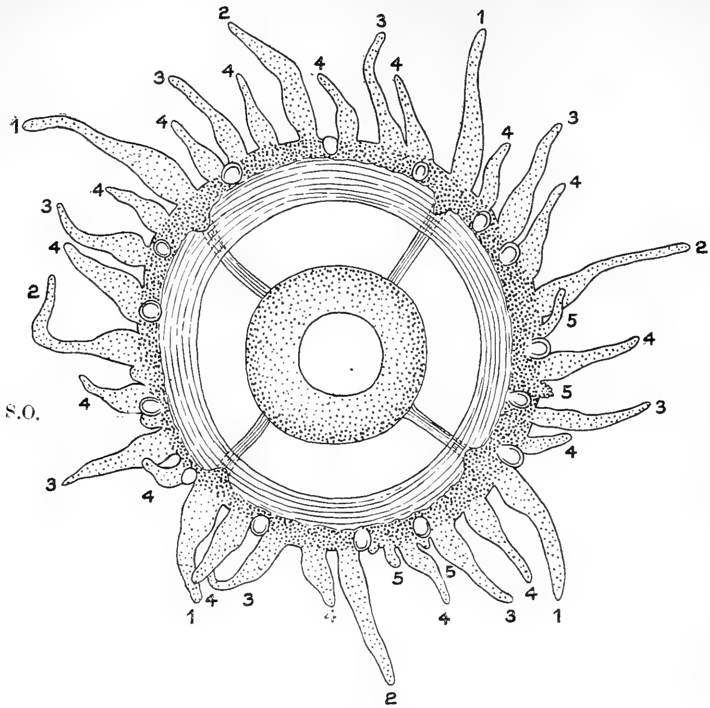
It is much to be regretted that no light has hitherto been shed upon the process of development from the egg. We have no sufficient reason for believing that the organisms described by Moore as the planulæ or larvæ of the *Limnocnida* really were such, and the existence of any free hydroid stage is as doubtful as ever. However, one fact of importance has been confirmed by all observers, namely, that the medusa may suddenly appear on the surface in countless numbers, in shoals many miles in length, and as suddenly disappear so that none are to be seen for a month or more.

The excellent state of preservation of Dr. Cunnington's material has enabled me to realise the natural appearance of a living *Limnocnida* when swimming, more perfectly than when I received Mr. Moir's first consignment of preserved material. The longer and older tentacles are carried somewhat stiffly above the exumbral surface of the medusa (Pl. XXXVII.), while the smaller and younger series of somewhat clubbed "velar" tentacles, as they are sometimes called, curve round the umbral rim. Tentacles of intermediate length occupy intermediate positions, and so the living animal can erect over its back a very efficient *chevaux de frise* armed with nematocysts for offence and defence. This fashion of carrying the tentacles is like that adopted by *Limnocodium* and *Olindioides*, in which latter form the tentacles adhere to the exumbrella along a more considerable proportion of their length than in *Limnocnida*, an adhesion which affords greater stability to the system.

Another point on which Dr. Cunnington's collection throws welcome light, is that of the succession and development of the tentacles. While still attached to the parent, the young medusa-buds develop the first two orders of tentacles in the per- and interradii (Pl. XXXVII. fig. 7). The youngest free-swimming stages in the collection, 2 millimetres in diameter, have the tentacles of the fifth order just commencing to sprout (text-fig. 172). Between these young stages and the oldest with tentacles of the eighth order and 22 millims. in diameter, the intermediate stages are fairly completely represented.

The peculiar sense-organs first become conspicuous in young medusæ in which tentacles of the fifth order are appearing, but they are not invariably present at this stage. In the youngest animals in which they were detected, there were four (text-fig. 172) in each quadrant, or 16 in all, although minor irregularities may occur, as in the specimen shown in text-fig. 172, in which only 15 sense-organs were present, and thenceforth they increase in number, until they are so numerous and crowded as to be almost touching one another all round the circumference of the medusa (text-fig. 174, S.O.).

Text-fig. 172.

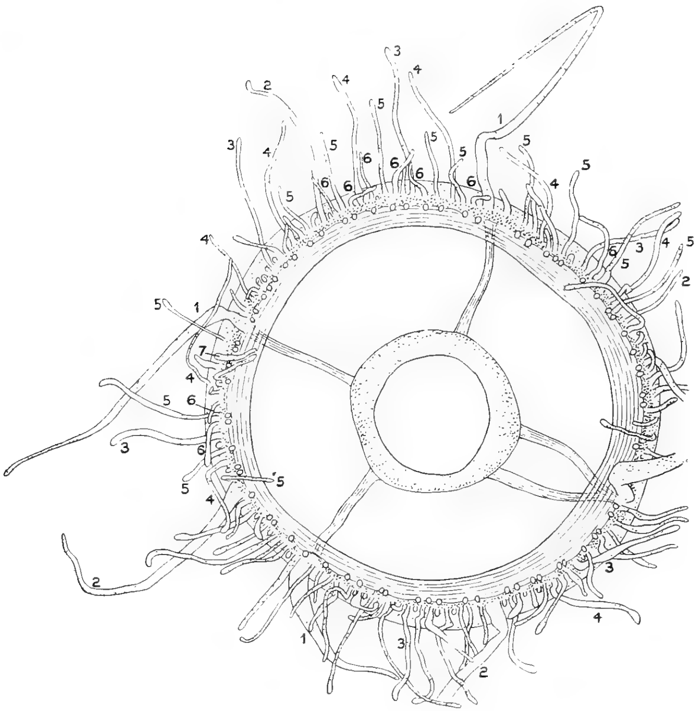


Young *Limnocnida*, 2 millimetres in diameter.

The numerals indicate the orders of the tentacles.

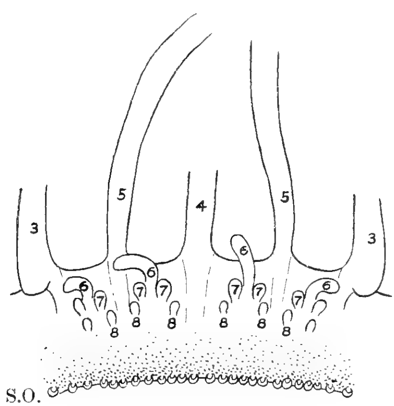
Endodermal Organ and Nutrition.—Among other problems which yet remain to be solved is that of the function of the remarkable accumulation of roundish cells in the circular canal. These cells have several nuclei apiece and many have one or two vacuoles. In the original description, an excretory function was suggested on the assumption that these cells were derived from the endoderm of the animal itself. On reexamining this so-called endodermal organ in better preserved material, I have found amœboid cells among the others (Pl. XXXVII. fig. 3), but feel more than ever in the dark with respect to their function, although probably it is in some way connected with the metabolism of the medusa. We hope that some naturalist having the opportunity may thoroughly investigate the method of nutrition of the living animal, bearing in mind the possibility of the growth of a parasitic or symbiotic fungus or alga in such a position. The wonderfully large mouth which the short manubrium seems inadequate to close, leads one to suspect some such peculiarity in the nutrition of *Limnocnida*.

Text-fig. 173.



Young *Limnocnida*, 6 millimetres in diameter, with five radial canals.

Text-fig. 174.



Portion of periphery of *Limnocnida*, 22 millimetres in diameter.

Radial Canals and Radial Symmetry.—In all large collections of *Limnocnida*, several individuals occur which exhibit numerical variation in the radial canals. (*Cf.* tables on pp. 648–650). Among 70 individuals of all ages brought home by Mr. Cunnington in which the radial canals could be counted, 54 showed the typical number of radial canals (4), 9 had 5 radial canals, 6 had 6, and 1 had 7 radial canals, so that as large a proportion as 24 per cent. have 5 or more radial canals. In this connection it is interesting to note that the numerical variation of the tentaculocysts of *Aurelia aurita* was found by Browne (Biometrika, vol. i.) to affect nearly as large a percentage (20·9–22·8 per cent.) of the individuals showing the normal number.

In many medusæ in which "supernumerary" radial canals occur, the additional canals are clearly seen to be due to the bifurcation, near the gastric cavity, of one or more of the normal number of radial canals. In no specimen of *Limnocnida*, and sixteen were examined, was this seen to be the case: all the radial canals proceeded independently from the gastric cavity to the circular canal; the confluence shown in text-fig. 173 being quite exceptional.

As might be expected, the order of the appearance of tentacles and the number of sense-organs tend to become more irregular in the case of individuals with 5 or more radial canals. *E.g.*, in the case of three individuals of different ages, and 14, 7 and 4·5 mm. in diameter, the numbers of the sense-organs in each fifth of the periphery were

III *a*. 40 + 35 + 48 + 40 + 41 = 204.
f. 19 + 21 + 21 + 22 + 18 = 101.
i. 10 + 6 + 6 + 6 + 8 = 36.

And so too, in the case of individuals with the normal number of tentacles, tentacles of a particular order are often fully formed in one quadrant before there is any sign of them in another.

Such variations may be expected to be frequent in the case of medusæ in which a numerically high grade of radial symmetry is reached.

Detailed Report on the individual specimens of Limnocnida *collected by Dr. Cunnington.*

I. Date: August 31, 1904. Locality: Niamkolo Bay.

	Diam. in millims.		No. of Radial Canals.	No. of Sense Org.	Order of Tentacles.	Char. of Manubrium.
	Umbrella.	Manubrium.				
a......	18	12	4	83×4	VIII.	Smooth.
b......	15	8	5	...	VIII.?	Smooth.
c......	14	9·5	4	...	VIII.	Buds (8 tent.).
d......	14	9	4	75×4	VIII.	Buds (8 tent.).
e......	14	8	4	...	VIII.?	Sm. (ribbed).
f......	13	7	5	...	VII.	Sm. (ribbed).
g......	10	7	4	...	VII.	Buds.

II. Date: September 9, 1904. Locality: Niamkolo Bay.

	Diam. in millims.		No. of Radial Canals.	No. of Sense Org.	Order of Tentacles.	Char. of Manubrium.
	Umbrella.	Manubrium.				
a......	22	15	4	106×4	VIII. (appearing)	Sm. (ribbed).
b......	22	15	4	...	do.	Young buds.
c......	22	15	4	...	do.	Buds (8 tent.)
d......	22	15	4	...	do.	Smooth.
e......	21	14	4	...	do.	Buds.
f......	20	14	4	...	do.	Buds.
g......	20	14	4	...	do.	Smooth.
h......	18·5	14	4	...	do.	Buds.

III. Date: December 20, 1904. Locality: Kibwesi.

	Diam. in millims.		No. of Radial Canals.	No. of Sense Org.	Order of Tentacles.	Char. of Manubrium.
	Umbrella.	Manubrium.				
a......	14	8	5	204	VIII.	Buds.
b......	13	8	6	.	VII.	
c......	13	8	4	..	VIII.?	..
d......	13	7	..	..	.	.
e......	10	4·5	..	.	.	...
f......	7	3·5	5	101	VII.	Smooth.
g......	6	2·5	5	68	VII.	
h......	6	2·5	6	14×4	VI.	
i......	4·5	2	5	36	V.	
j......	4	2·25	4	..	V.	
k......	4	1·5	5	.	V.	
l......	4	1·5	4	?8×4	VI.	
m......	4	1·5	4	..	V.	
n......	4	1·5	4	..	V.	
o......	3·75	2	4	...	VI.	
p......	3·5	1·5	4	8×4	VI.	
q......	3·5	1	4	.	V.	
r......	3	1·5	4	..	V.	
s......	2·75	1·5	...	...	..	
t......	2·75	1·25	..	..	...	
u......	2·5	1·25	5	...	V. (appearing).	
v......	2·5	1·25	4	Yg. S. O.	...	..
w......	2·5	1·25	4	...	V.	
x......	2·5	1	4	.	V.	...
y......	2·25	1	4	...	V. (not all round).	
z......	2	1	4	...	V. (not all round).	
α......	2	·75	..	...	...	
β......	2	·75	4	...	V. (just appearing).	

IV. Date: February 21, 1905. Locality: Menza.

	Diam. in millims.		No. of Radial Canals.	No. of Sense Org.	Order of Tentacles.	Char. of Manubrium.
	Umbrella.	Manubrium.				
a......	17	12·5	4	very numerous.	VIII.	Buds.
b......	16	9	4	very numerous.	VIII.	Young buds.
c......	15	10	4	...	VIII.	...
d......	14·5	9	4	36×4	VII.	Buds.
e......	14·5	9	4	...	...	...
f......	14·5	8	4	...	IX app.	Smooth.
g......	14	9	4	...	VII.	Small buds.
h......	13	6	4	26×4	...	Smooth.
i......	11	5	4	...	VIII.	...
j......	9	4·5	...	...	VII.	...
k......	8	4·75	6	? 97	VII. app.	Smooth.
l......	8	2·5	4	21(–18)×4	VI.	...
m......	7·75	3·25	4	18×4	VII. app.	Smooth.
n......	7·5	4·25	7	...	VI. app.	...
o......	7·5	4	4	...	VIII. app.	...
p......	7·5	4	4	26×4	VII. app.	Smooth.
q......	7	4	4	...	V.	...
r......	7	3	6	...	VI–V	...
s......	6·25	2·75	4	...	VII. app.	...
t......	5·5	2·25	4	...	VII. app.	...
u......	5	2·75	4	...	VI.	...
v......	5	2·5	5	...	VI. app.	...
w......	5	2	4	16(–15)×4	VI. app.	...
x......	5	1·75	4	18×4	VI. app.	...
y......	5	1·75	4	...	VI. app.	...
z......	4·25	2·25	6	76	VI.	...
α......	4·25	2	...	...	VI.	...
β......	4·25	2	6	...	V.	...
γ......	3·5	1·75	4	9×4	V.	...
δ......	3·5	1·25	4	...	V. app.	...
ε......	3·5	1·25	4	...	V. app.	...
ζ......	3·25	1·25	4	8×4	V.	...
η......	3	1	4	8(–9)×4	V. small.	...
θ......	2	·75	4	8×4	V. app.	...

For the sake of comparison a similar table is appended for *Limnocnida tanganicæ* var. *victoriæ* obtained by Sir Charles Eliot.

Date: August 31, 1903. Locality: Kisumu, Victoria Nyanza.

	Diam. in millims.		No. of Radial Canals.	No. of Sense Org.	Order of Tentacles.	Sex.
	Umbrella.	Manubrium.				
a......	13·5	8	4	circ. 30×4	VII.	mature ♀.
b......	13	7·5	4	,,	VII.	mature ♀.
c......	12·5	8	4	,,	VII.	mature ♀.

LIMNOCNIDA TANGANICÆ * var. VICTORIÆ.

On comparing some shrunken and rather battered specimens of *Limnocnida* obtained by Sir Charles Eliot, K.C.M.G., from the Victoria Nyanza, with the Tanganyika material, I considered that I could detect differences in the specimens from the Victoria Nyanza which may be regarded as sub-specific in importance: the proximal ends of the older tentacles are more deeply sunk in the jelly of the ex-umbrella than is the case in *Limnocnida tanganicæ* and the jelly-mass is more deeply grooved in consequence (Pl. XXXVII. figs. 4 & 5).

About one third of the length of the older tentacles is smooth and free from nematocyst warts, which are confined to the distal two-thirds. The proximal ends of the tentacles which are adherent to the exumbrella are specially supported by the development of grooved lumps or ridges of jelly in which they lie. I have never seen these so strongly developed in any *Limnocnida* from Lake Tanganyika. The sense-organs were numerous, and very prominent on the margin of the umbrella.

The specimens examined were all females of about the same age, with mature ova on the manubrium, and with tentacles of the VIIth order.

This collection was referred to by Prof. Sir Ray Lankester, at a meeting of the Zoological Society on December 1st, 1903. The medusæ were captured by Mr. Hobley at Kisumu on August 31, 1903, and had been preserved in a 5 °/₀ solution of formalin.

The extremely interesting fact of the occurrence of a form apparently identical with *L. tanganicæ* in the delta of the river Niger about 102 geographical miles from the sea, proves that *Limnocnida* must no longer be regarded as peculiar to the deep-water lake Tanganyika, but that it has a wide distribution in the fresh waters of tropical Africa. And as a consequence the halolimnic theory, according to which Tanganyika is a persistent Jurassic sea, in so far as it has been based upon the belief of the *exclusive* occurrence of *Limnocnida* in that lake, falls to the ground.

With regard to the details of the change from a marine to a fresh-water environment, we have yet much to learn from a more searching study of Central African geology. Of all the theories which have yet been proposed, we find ourselves most in agreement with that outlined by Mr. Boulenger for the benefit of the British Association in South Africa (1905), but the details of this theory of a wide-spread Eocene Sea still require working out.

More recently an original speculation has been published by Prof. Sollas. Of *Limnocnida* my imaginative friend writes ('Age of the Earth,' p. 209)—"If while in the hydroid stage, it grew

* This would seem an appropriate occasion for advocating a more reasonable uniformity in the spelling of this specific name; and although in my original paper I had followed Böhm's spelling *tanganyicæ* in accordance with the laws of priority, in the present communication the more usual and shorter form *tanganicæ* is adopted. I have noted *tanganyicæ, tanganicanus, tanganicensis, tanganyikæ, tanganyicensis, tanganikæ*, and in Sollas's 'Age of Earth,' p. 209, *tanganyicoea* (!)

attached to the outer skeleton of some actively locomotive animal, such for instance as one of the reptiles which abounded in Mesozoic times, and even at a later date, then, on the further supposition that its host sometimes made excursions from the sea into fresh-water, we should have a means by which the hydroid might be introduced."

Unfortunately for this theory, there is no evidence of any fixed hydroid stage in *Limnocnida*, indeed the evidence is all against the existence of one: *Aurelia aurita*, *Crambessa tagi*, and *Mæotias* have all left the sea without the aid of a marine reptile: *Halmonises lacustris* was probably helped into fresh-water by tidal agencies alone, and, as Sir Ray Lankester has suggested, *Limnocodium* may not pass through a fixed hydroid stage at all!

The Systematic Position of Limnocnida.

The position of *Limnocnida* in the Haeckelian System is still a matter under discussion. Judged by the chief diagnostic characters of endodermal sense-organs and manubrial gonads, *Limnocnida* should be one of the Narcomedusæ; but, on the other hand, Narcomedusæ are distinguished by characters so peculiarly their own, that *Limnocnida* cannot be considered as being at all closely related to them. Moreover, I know of no Anthomedusan which at all resembles it, except in the position of the gonads on the manubrium.

On the other hand, the grade of development which *Limnocnida* has reached is very closely paralleled by that of the other fresh-water medusa *Limnocodium*, more especially in regard to the tentacles and sense-organs, as I have already pointed out in an earlier communication. More recently (1903) Seitaro Goto has published illustrations of the sense-organs of the marine *Olindioides* clearly showing them to be of the same type. This distinguished Japanese naturalist has associated *Olindioides*, *Halicalyx*, and *Gonionema* with the Olindiadæ, which he regards as a subfamily of Eucopidæ (we believe wrongly) and near which he believes that both *Limnocodium* and *Limnocnida* may be most naturally placed.

The Olindiadæ are defined as Eucopidæ (see below) with two sets of tentacles, velar and exumbrellar, the former springing close to the base of the velum, and the latter at variable distances from it, but always from the exumbrella and connected with the circular canal by endodermal roots: marginal vesicles numerous, two on either side of the bases of the exumbrellar tentacles: manubrium well developed and quadrate, with distinct lips: radial canals four or six: gonads primarily continuous folds of the walls of the radial canals: with an adhesive disc on each exumbrellar tentacle.

The greater part of this definition applies quite well to the fresh-water *Limnocodium sowerbyi*, with the exception that this species, not being a creeping form, has tentacles without adhesive discs, and has also sac-like gonads.

Limnocnida too, shows a similar type of structure excepting that the gonads are situated on the manubriun in a zone in which bud-formation normally occurs, and would consequently belong to the Anthomedusæ or to a division of medusæ with manubrial gonads which, according to the System of Haeckel, are absolutely distinct from the Olindiadæ, *Limnocodium*, or any other medusæ with radial gonads. We have therefore an indication that the time has arrived for a reconsideration of the value of the characters upon which this System is founded. May they not tend to an artificial rather than to a natural classification of medusæ?

On the whole we incline to the opinion that the hard and fast division of medusæ into those with radial and those with manubrial gonads must be abandoned in the case of these fresh-water forms. We cannot imagine that the detailed resemblances which exist between *Limnocodium*, *Limnocnida*, and the Olindiadæ are the result of convergent evolution. A simpler hypothesis is that these forms are descended from a common ancestor, but that the place of development of the germ-cells has changed.

Arguing from known facts about the migratory proclivities of germ-cells in Hydroids in general, and from the history of the germ-cells of *Obelia* in particular, in which Leptomedusan the germ-cells, although maturing in pouches of the radial canals, originate in the wall of the manubrium itself, there is good ground for the view that *Limnocnida* in respect of its manubrial gonads preserves an early stage in the phylogenetic history of *Limnocodium*. Just as Odontornithes are none the less birds because they have teeth, so *Limnocnida* would be a Trachomedusan in spite of its manubrial gonads.

One other taxonomic problem has still to be dealt with. In Haeckel's system the Olindiadæ are regarded as a subfamily of the Trachomedusan Petasidæ, which have blind centripetal canals between the radial canals, and are thereby distinguished from the Petachnidæ. Goto, however, does not consider the presence of such canals to be of any systematic moment, since they may be present or absent in closely related genera. It is to be remembered that such centripetal canals, as well as the marginal ring of nematocysts, are well marked Trachomedusan features.

The Olindiadæ have usually been regarded as Trachomedusæ, until four years ago when Seitaro Goto made an examination of young stages of the sense-organs of *Olindioides formosa* and of *Gonionema depressum*. He found that the first rudiment consisted of a small segregation of *ectodermal* cells hardly distinguishable from the rest, closely applied to the endoderm of the circular canal at the point where the two kinds of cells meet (pl. ii. fig. 15), and he goes on to add that "there cannot be any reasonable doubt that the rudiment consists exclusively of *ectoderm cells*, since the boundary line between the two cell-layers is always distinguishable with a good objective."

In consequence Goto removed the Olindiadæ from the Trachomedusæ and ranged them with the Leptomedusæ, considering them as a subfamily of Eucopidæ. With this conclusion my own observations are at variance, and we do not consider that Seitaro Goto's own drawing (pl. ii. fig. 15) makes his statement evident.

With the aid of Dr. Cunnington's material I have again been able to confirm my original observation that the axial cells of the sense-organs of *Limnocnida* are derived from the *endoderm* of the circular canal. I have repeated the same observation in the case of *Olindias mülleri* while at Naples, and in the latter observation I believe I have the support of Sir Ray Lankester.

In both cases I have not been able to distinguish any boundary line between ectoderm and endoderm in the youngest stages of the sense-organs, although a distinct mesoglœal lamina appears between the two layers when the sense-organ approaches full growth. A further indication of the endodermal nature of these cells is afforded by an observation of Seitaro Goto himself, who admits that the central cells of the organ "stain the same colour as the endoderm, while the lining epithelium and the investing cells stain like the ectoderm."

In conclusion then, *Limnocnida* is to be regarded as a Trachomedusa related to the Olindiadæ and to *Limnocodium*, both of which it closely resembles in important respects, but it differs from all other known Trachomedusæ in that the gonads develop upon the walls of the manubrium. *Olindioides* and *Gonionema* differ from *Limnocnida* in the presence of centripetal canals and in the fact that their tentacles are provided with adhesive discs for use in creeping. In *Limnocodium* the vesicles enclosing the sensory bodies are elongated and extend into the velum, in *Limnocnida* they do not. *Limnocnida* too is characterised by its power of reproduction by budding from the manubrium.

The consequential changes in the scheme of classification cannot be regarded as more than tentative, for the details of the structure of many of the Haeckelian genera are still unknown. A most important character for taxonomic purposes is undoubtedly that of the structure of the sense-organs—whether they project freely beyond the margin of the umbrella as sensory clubs, or whether they are sunk and enclosed in vesicles. On these lines, Browne has divided the Petasidæ into the subfamilies Petachnidæ (with sensory clubs) and the Olindiadæ (with sensory vesicles). It is to the division of Olindiadæ without adhesive discs on the tentacles that I would provisionally refer *Limnocodium* and *Limnocnida*.

TRACHOMEDUSÆ.

Sense-organs with endodermal axis; gonads usually radial; development without a fixed hydroid stage.

[The radial position of the gonads is believed to have been derived from a manubrial position. *Limnocnida* is believed to have "thrown back" to the older condition. *Limnocodium* has never been *proved* to pass through a fixed hydroid stage.]

Family PETASIDÆ.

Radial canals 4 (or 6) in number; stomach without a peduncle.

Subfamily 1. Petachnidæ.

Sense-organs, projecting clubs.

Petasus, *Petasata*, *Dipetasus*, *Petachnum*.

Subfamily 2. Olindiadæ.

Sense-organs, enclosed in vesicles.

Group A. Tentacles without adhesive discs.

Marine forms.

Aglauropsis (? including *Mæotias*).

Gossea.

Olindias (? including *Halicalyx*).

Freshwater forms.

Limnocodium. Gonads radial, sac-like. Vesicles of sense-organs elongated and continued into velum.

Limnocnida. Gonads manubrial. Vesicles of sense-organs spherical or ellipsoidal. Asexual reproduction by budding.

Group B. Tentacles with adhesive discs.

Gonionemus, *Gonionemoides*, *Vallentinia*, *Olindioides*.

References.

1893. Günther, R. T.—"Preliminary Account of the Freshwater Medusa of Lake Tanganyika (*Limnocnida tanganicæ*)." Ann. Mag. Nat. Hist. ser. 6, xi. pp. 269–275, pls. xiii. & xiv.

1894. Günther, R. T.—"A further Contribution to the Anatomy of *Limnocnida tanganicæ*." Quart. Journ. Micr. Sci. xxxvi. pp. 271–293, pls. 18–19.

1894. Guerne, Jules de.—"On a Medusa observed by Dr. Tautain in the River Niger at Bamakou (French Soudan)." Ann. Mag. Nat. Hist. ser. 6, xiv. pp. 29–34.

1903. Gravier, C.—"Sur la Méduse du Victoria Nyanza." Comptes rendus Acad. Sci. cxxxvii. pp. 867–869.

1903. Goto, Seitaro.—The Craspedote Medusa *Olindias* and some of its natural allies. Mark Anniversary Volume, pp. 1–22, pls. i.–iii.

1904. Moore, J. E. S.—The Tanganyika Problem.

1904. Browne, Edw. T.—"Hydromedusæ." Fauna and Geogr. Maldive Archipelago, vol. ii., Cambridge.

1906. Cunnington, W. A.—"Third Tanganyika Expedition." 'Nature,' lxxiii. p. 310, 1906.

1906. Browne, Edw. T.—"On the Freshwater Medusa *Limnocnida tanganicæ* and its Occurrence in the River Niger." Ann. Mag. Nat. Hist. ser. 7, xvii. pp. 304–306.

EXPLANATION OF PLATE XXXVII.

Fig. 1. *Limnocnida tanganicæ.* From a specimen in which the tentacles of the seventh order have appeared.
2. Transverse section of tentacle.—*end.* Endodermal lining of tentacle. *gl.* Mesoglœa of exumbrella.
3. Transverse section of radial canal (*R.C.*). *end.* Endoderm of radial canal. *end. l.* Endoderm lamella. *c.* Problematical corpuscles in radial canal.
4. Surface view of the periphery of the umbrella of a specimen of *L. tanganicæ* var. *victoriæ* from which the tentacles have become detached.—*r.* The grooved ridges in which the tentacles of orders 1 to 6 were partly imbedded.
5. Ditto, in transverse section.
6. Portion of bud-bearing manubrium of *L. tanganicæ.* One part has become detached as described by Mr. J. Moore.
7. Ditto, with older medusa-buds having tentacles of the first and second orders developed.

7. Notes upon some African Species of the Genus *Felis*, based upon specimens recently exhibited in the Society's Gardens. By R. I. Pocock, F.L.S., Superintendent of the Gardens.

[Received May 28, 1907.]

(Plate XXXVIII.* and Text-figures 175–178.)

On Felis aurata *Temminck.*

The synonymy of this species is as follows:—

Felis aurata Temminck, Mon. Mamm. i. p. 120 (1827).
,, *celidogaster* id. *op. cit.* p. 140.
,, *chrysothrix* id. *op. cit.* p. 251.
,, *chalybeata* H. Smith, Griff. An. King. ii. p. 474 (1827), *nec* Herm.
,, *neglecta* Gray, Ann. Nat. Hist. i. p. 27 (1838).
,, *rutila* Waterh., P. Z. S. 1842, p. 130.
,, *chrysothrix cottoni* Lydd., P. Z. S. 1906, p. 992.

Although *chrysothrix* has been more commonly employed for this species than either *aurata* or *celidogaster*, *aurata* appears by right of page priority to be its oldest available title. The name *chrysothrix* was proposed by Temminck to replace *aurata*, apparently because he had learnt from Desmarest's work that Rafinesque had applied the name *aureus* to a North American species of *Lynx*. *Aureus*, however, does not exclude *aurata* from use in the same genus; and even if Rafinesque had written *auratus*, a good case could be made out for the retention of *aurata* Temm., on the grounds of generic distinction between the species so named and the Lynx described by Rafinesque. But if *aurata* be set on one side, as has been commonly done, *celidogaster* should be preferred to *chrysothrix* by those who, like Dr. Elliot, Pousargues, and Mr. Lydekker, believe the two names to belong to the same species.

* For explanation of the Plate, see p. 677.

London Stereoscopic Co. imp.

SKINS OF SERVALS AND SERVALINE CATS.

By a curious chain of circumstances *F. celidogaster* and *F. chalybeata* had the same type specimen, and are therefore in the strictest possible sense synonyms. Smith gave the name *chalybeata* to a skin in Bullock's Museum, which he believed went afterwards to Germany. Temminck, as he himself says, bought the skin from that Museum, without knowing apparently that Smith had already compiled a description of it.

Although the name employed by Smith was published in the same year as the three names employed by Temminck, it has never met with acceptance, probably because of its previous use in a different sense in the genus *Felis* by Hermann.

The specimen named *F. neglecta* by Gray is not distinguishable from *F. celidogaster* as described by Temminck, as Dr. Elliot has shown; and the description of *F. rutila* Waterh. might, from its wording, have been taken from the type of *F. aurata*.

Thus of the six names published between 1827 and 1842 two only have to be considered as connoting distinguishable forms, namely *aurata* (*chrysothrix*) and *celidogaster*. The former was given to a "red" and the latter to a "grey" West African Tiger-Cat.

Up to the present time there has been considerable divergence of opinion as to the value to be assigned to these two "forms." Dr. Elliot * and Pousargues † regarded them merely as colour-phases without geographical significance. Dr. Matschie ‡, on the other hand, gave them full specific value. The latest writer on the subject, Mr. Lydekker §, adopted a third course. While agreeing with Dr. Elliot and Pousargues that only one species is concerned, he believed, with Dr. Matschie, that the above-mentioned "forms" occur in definite localities. He gave them, however, subspecific rank, resuscitated "*rutila*" as a third subspecies and added a fourth, *cottoni*, which was described as new.

His conclusions may be briefly summarised as follows:—

1. *F. chrysothrix rutila.* Red form. Gambia and Cameroons.
2. *F. c. typica* ‖. Brown form. Lower Guinea.
3. *F. c. celidogaster.* Grey form. Upper Guinea; (?) Gambia.
4. *F. c. cottoni.* Dusky form. Ituri forest.

It can, however, I think be shown that the conclusion respecting the local distribution of the colour-types is untenable.

This opinion is supported by the following facts. Although the locality of the type of *F. aurata* (= *chrysothrix*) was unrecorded, the type of *F. rutila* came from the Mandingo country inland of Sierra Leone. The locality of the type of *F. celidogaster* was also unknown, but Temminck subsequently obtained a skin he identified as *F. celidogaster* from Ashanti ¶; and under the name

* Mon. Felidæ, pl. xxv. (1883). † Ann. Sci. Nat. (8) iii. p. 322 (1896).

‡ Mitth. deutsch. Schutz. vi. pt. 3, p. 10 (1893); SB. Ges. Nat. Fr. Berlin, 1895. p. 196.

§ P. Z. S. 1906, pp. 992–995. These authors use the name *chrysothrix*.

‖ Temminck, however, described this as "*roux-bai très vif.*"

¶ Esquisse Zool. Guiné, pp. 86–88 (1853).

F. neglecta, Gray redescribed *F. celidogaster* from Sierra Leone. Thus, since *neglecta* and *rutila* are respectively synonyms of *celidogaster* and *aurata*, it appears that both the "grey" and the "red" forms occur in the neighbourhood of Sierra Leone.

Karsch records *F. aurata* (*chrysothrix*) from Bismarckburg in Togoland *; Pousargues examined skins of the grey-brown type obtained from natives in the French Congo †; and Sir Harry Johnston declares that the "red" and the "grey" types live side by side in Liberia ‡.

Thus the published localities can scarcely be said to support, though they do not wholly discredit, the belief that the "red" and the "grey" forms represent geographical races.

A study of the skins available for examination still further refutes the idea.

In the British Museum there are in all seven skins of this species. Their characters and other particulars regarding them are as follows:—

1. Cameroons (*G. L. Bates*).—Bay-red; dorsal area not spotted, sides faintly marked with small close-set spots; outer side of limbs faintly spotted; tail with decided median black stripe, not barred; ventral surface yellowish (? discoloured), marked with large dark brown spots. This belongs to the *F. aurata*-type.

2. Cameroons (*G. L. Bates*).—Differs from the last in being a dirty greyish-brown washed with yellow on the sides and rather more clearly spotted. Dirty white below. This comes nearest to the *F. celidogaster*-type.

3. Cameroons (*G. L. Bates*).—Like no. 2 in colour but with less yellow on the sides and with the median area of the back darker and more sharply contrasted with the sides in tint. This also is nearest to the *F. celidogaster*-type.

4. Benito River, Congo, 25 miles from coast (*G. L. Bates*).—Like no. 1 in markings and general tint, but not quite so bright a red.

5. Senegal § (*Winwood Reade*).—Practically like nos. 1 and 4.

6. Sierra Leone (type of *neglecta* Gray).—Grey, greyer than nos. 2 and 3 and spotted all over, the spots in the middle area of the back forming abbreviated longitudinal streaks. As already stated, this belongs to the *F. celidogaster*-type.

7. Ashanti; obtained from dealer.—Spotted all over, the spots forming comparatively large blotches darker and more rufous than the ground-colour, which on the sides of the body is greyish, but is decidedly more rufous on the head, neck, the dorsal area, the tail, and the legs. The tail has a median dorsal line and distinct lateral bars.

* Mitth. deutsch. Schutz. vi. pt. 3, p. 10 (1893).
† Ann. Sci. Nat. (8) iii. p. 322 (1896).
‡ 'Liberia,' ii. p. 702 (1906).
§ The locality of Winwood Reade's collection is doubtful, Mr. Thomas tells me.

In the size, distinctness, and the suggestion of the rosette-shape in the spots, this specimen resembles more closely than any that I have seen the example from near Cape Coast Castle, that formerly lived in the Gardens, and was figured by Dr. Sclater on pl. xxvii. in the 'Proceedings' for 1873.

In the collection of the Zoological Society there are three complete skins:—

1. W. Africa; obtained from a dealer and therefore without trustworthy locality.—General coloration rufous, greyer on the sides than on the back, neck, head, and tail. Marked all over with reddish-brown spots, forming indistinct lines on the back, neck, and head; tail with median line and indistinct bars. This must be regarded as a rufous form of *F. celidogaster*. It is somewhat like no. 7 of the above-given B. M. series; and also like the example from Cape Coast Castle figured by Dr. Sclater, but is less distinctly spotted than either.

2. Accra.—Differs principally from the last in being of a grey or slightly brownish-grey colour all over, the spots being dark brown instead of rufous-brown. The crown of the head is very distinctly striped and the postocular stripe is well defined. This appears to be typical *F. celidogaster*.

3. Sierra Leone.—This specimen is by far the most interesting of the three. It agrees almost exactly with the skin Mr. Lydekker made the type of *F. c. cottoni*, remarking that its dark hue is evidently an adaptation to its habitat in the Ituri forest. Our specimen, however, came from Sierra Leone, considerably over 2000 miles from the Ituri forest. Nor is this all. When first imported and presented to the Society by Mr. Hudson on June 21st, 1906, the live specimen was unspotted, except beneath, and of a rufous-brown colour exactly recalling the tint of a rich dark-hued Puma (*F. concolor*). *But in four months' time the colour entirely changed from rufous to grey.* This was effected by the fading of the pale band in the distal half of each individual hair from red to nearly white, the white with the terminal black portion combining to produce the grey tint. Unfortunately, the animal died in November, so that no further observations could be made; but happily he lived long enough to prove that the rufous and the greyish phases may succeed one another in a comparatively short space of time in the life-history of a single individual of this species*. That such a change might occur was suspected by Dr. Elliot, who noticed that in the type of *F. celidogaster* Temm. the end of the tail was red like that of the type of *F. chrysothrix*, "as though the animal had been changing its coat from one colour to the other." This gave him the idea that the change might be seasonal. The truth of the suspicion as to the

* What is true of this species may also be true of others. Several species of Cats are known to be dimorphic in colour, like, for example, *F. jaguarondi*. But no actual change of the one colour into the other such as is described above, has as yet been recorded.

occurrence of the change is fully confirmed; but whether it is seasonal or not still remains unknown. It is, however, possible that the new coat is always red, and fades to grey before being replaced at the end of the year.

The above mentioned facts prove conclusively that the "colour" cannot be used as a basis for splitting *Felis aurata* into two or more local races; since the red and the grey phases may succeed one another in the life of the individual; and red and grey individuals occur side by side in the same localities. On the other hand, the material available for examination seems to justify the provisional recognition of two subspecific forms distinguishable by "pattern," that is, by the size and distribution of their spots. These may be defined as follows:—

a. *F. aurata celidogaster* (=*chalybeata*+*neglecta*).

Primitive form; red or grey in colour, but spotted or striped on the crown of the head, the neck, and the median area of the back; the spots on the sides of the body distinct, of comparatively large size and comparatively few in number. Tail distinctly or indistinctly banded.—Sierra Leone, Liberia, Ashanti, Cape Coast Castle, Accra.

b. *F. aurata aurata* (=*chysothrix*+*rutila*+*cottoni*).

Derivative form; red or grey in colour, with the pattern evanescent on the head, neck, and dorsal area of the body, but generally retained on the sides as small, numerous, close-set spots; tail not or only indistinctly banded.—Sierra Leone, Mandingo Country, ? Liberia, "hinterland von Bismarckburg" *, Cameroons, Bènito River; and the French Congo † eastwards to the Ituri forest.

It must be freely conceded, however, that the arguments in favour of the subspecific distinctness of *F. a. aurata* and *F. a. celidogaster* on the characters I have indicated are somewhat weakened by the recorded occurrence of both forms in Sierra Leone and possibly in Liberia.

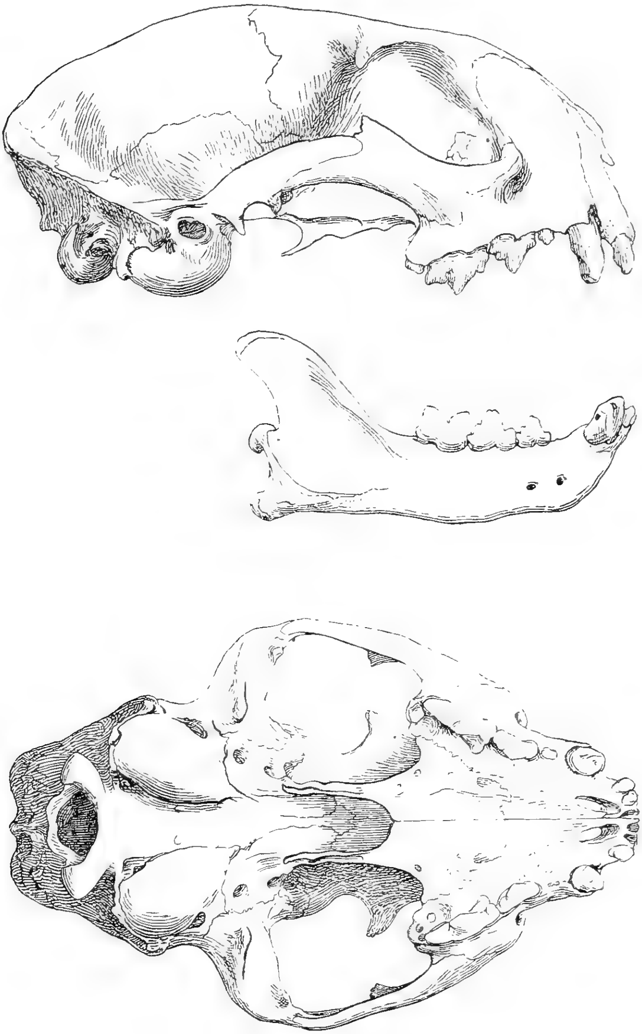
Of the specimens of this Cat obtained by Sir Harry Johnston in Liberia ('Liberia,' vol. ii. 1906), those represented on the plate and by the right-hand photograph on p. 703, evidently belong to the large-spotted or *F. a. celidogaster*-form. Regarding the other I am a little in doubt. But it appears to belong rather to the *F. a. aurata*-form. The two flat skins, obviously native-prepared, are said to have come from the same locality. Sir Harry Johnston repeats Matschie's statement that the grey form is larger than the red. I can find no evidence of any value bearing upon this point. Indeed, of the two skins photographed in Sir Harry Johnston's book, the one of the red type is longer than the other measured from the root of the tail to the fore part of the shoulder.

* Karsch, Mitth. deutsch. Schutz. vi. pt. 3, p. 10 (1893).

† Pousargues describes two skins of this type obtained from natives of the Sanga and of the country of the Eschiras (Ann. Sci. Nat. [8] iii. p. 322, 1896).

There are two more interesting features to be noted in connection with this species. I have not seen it stated in any description that the hair on the upper side of the neck, from a

Text-fig. 175.



Skull of *Felis aurata*, $\frac{2}{3}$ nat. size.
(Specimen no. 2 of Zoological Society's series.
Lateral and ventral views.

point between the shoulders to a transverse line in front of the anterior rim of the ears on the crown of the head, *grows forwards.* This area is defined on each side by a crest, and is marked posteriorly by a single or double whorl on the shoulders. This is a most noticeable character in all the skins I have examined. It serves to distinguish the skins of *F. aurata* at a glance from those of all the small or medium-sized African and Oriental species of *Felis.* It is, however, paralleled in some South-American species like *F. pardalis* and *F. tigrina*, in which its systematic value does not appear to have been thoroughly worked out *.

The second character is the shape of the mesopterygoid fossa of the skull (text-fig. 175, p. 661), which is narrow and elliptically rounded in front, and thus differs from this fossa in all other African species of *Felis* and approaches that of some of the Oriental and South-American species. Indeed, I do not doubt that *F. aurata* is to be classified in a group of which *F. pardalis* is one of the South-American, and *F. temmincki* one of the Oriental representatives, and not with the groups exemplified in Africa respectively by *F. serval*, *F. caracal*, and *F. ocreata.*

As a working hypothesis, it may be held that this group to which *F. aurata* belongs originated in the Europæo-Asiatic continent and migrated thence in a south-easterly direction as far as Borneo. From the Oriental Region it passed into tropical West Africa. Into America it made its way probably by the Alaskan route and spread southwards through the continent as far as Chili and Patagonia. There is as yet no reason to think that *Felis* entered Africa at a sufficiently early date to pass direct to America by the transatlantic bridge, which is believed to have joined these two continents together formerly.

At the present time the distribution of this group is discontinuous; but there are many known instances of affinity between the faunas of the Congo basin in Africa and of the Indo-Malayan area of the Oriental Region; and also between the faunas of the latter area and of the Neotropical Region. Hence there is nothing extravagant in the claim that *Felis aurata* is nearly related to species now inhabiting those areas, despite its distributional isolation.

On FELIS SERVALINA *Ogilby.* (Plate XXXVIII. figs. 3, 4.)

Felis servalina Ogilby, P. Z. S. 1839, p. 4; Sclater, P. Z. S. 1874, p. 495, pl. lxiii.; Thomas, P. Z. S. 1888, p. 5; Lydekker, Cats etc., Lloyd's Nat. Hist. pp. 135–136 (1896).

Felis serval Elliot, Mon. Felidæ, pl. xxvi., 1883 (in part).

Trouessart (Cat. Mamm. 1906, p. 274), misled apparently by Gray (P. Z. S. 1867, p. 272), cites *F. servalina* Ogilby as a synonym of *F. chrysothrix.* This is an error. The type of *F. servalina* is

* See O. Thomas, Ann. Mag. Nat. Hist. (7) xii. pp. 235–237, 1903. This peculiarity is very well shown in the figure of an example of *F. tigrina* which Schreber printed as an illustration of *Felis onca* Linn. (Säug. iii. pl. cii.).

in the British Museum, and proves the correctness of Dr. Sclater's determination of the species as a Cat related to *F. serval* but closely speckled (P. Z. S. 1874, p. 495, pl. lxiii.). Dr. Elliot indeed, and following him Mr. Lydekker, gives *F. servalina* as a synonym of *F. serval* *.

I cannot ascertain with certainty where this form, even if it be regarded merely as a subspecies, is placed in Trouessart's Catalogue of Mammalia. I can only surmise that it is dismissed as a synonym of *Felis galeopardus* of Desmarest, with which, presumably on Matschie's authority, *F. senegalensis* Lesson is identified. If this be so a double error is involved, for *F. servalina* Ogilby is not identical either with *F. galeopardus* or with *F. senegalensis*, and *F. senegalensis*, judging from the figure, is different from *F. galeopardus*.

The descriptions and figures both of *F. galeopardus* and *F. senegalensis* leave no doubt that these two resemble the typical Serval in that the pattern on the neck, and at least the fore part of the back, consists of definite and tolerably widely separated longitudinal stripes. This is not the case in *F. servalina*. *F. galeopardus* and *F. senegalensis* are further discussed (p. 667) under the heading *F. serval*.

The exact systematic status of *F. servalina* is a question about which the opinions of authors are divided and undecided. In every particular but pattern, that is to say in general form, length and slenderness of limb, length of tail, size of ears, and form of skull, it resembles *F. serval*. Even in pattern the difference is rather one of degree than of kind. It is quite easy to imagine the transition from *F. serval* to *F. servalina* by the breaking up of the cervical, scapular, and spinal stripes and of the larger spots on the body in *F. serval* into a countless multitude of small close-set spots showing obscure indication of serial arrangement usually only on the spinal and cervical areas. The differences might well be regarded merely as of subspecific importance or perhaps as indicative of variation comparable, as Sir H. Johnston has remarked †, to that of the speckled leopard-skins recorded by Dr. Günther from Grahamstown in S. Africa (see *infra*, p. 676).

The available evidence, however, seems to me to be in favour of regarding *F. servalina* as a valid species. In the first place, there are, so far as I am aware, no skins showing a complete series of gradations between this form and the typical Serval ‡. This is opposed to the conclusion that the two are geographical races of the same species. In the second place, the distribution of

* It seems singular that Mivart when preparing his monograph of the Cats did not take the trouble to look up the type of *servalina* to settle the status of this form, but, after comparing the species with '*neglecta*,' dismissed it with the words "the type is said to be in the British Museum." (The Cat, p. 408, 1881.)

† 'The Uganda Protectorate,' i. p. 367, 1902.

‡ Sir H. Johnston ('Uganda Protectorate,' i, p. 366) says: "It is not very uncommon to see skins which are intermediate in markings between the extremely small and numerous spots of the Servaline and the bold black patches and stripes of the common Serval." The meaning of the term 'intermediate' is sufficiently lacking in precision

F. servalina appears to coincide very closely with that of many West African animals like the Chimpanzee, *Felis aurata* and others. In the British Museum there are skins from Senegal (Winwood Reade *), Sierra Leone (the type), Monbuttu (Emin Pasha), and Entebbe. In 1874 Dr. Sclater recorded it from Kinsembo on the borders of Angola and the Congo. Bocage saw skins from the interior of Angola and from Caconda †; and Sir Harry Johnston remarks that it is found in the Kingdom of Uganda and in the western province of the Protectorate. These localities suggest that *F. servalina* occurs on the fringe of the West African forest-region. How far it extends into the heart of that area is a matter for conjecture. The omission of the species from Pousargues's Catalogue of the Mammalian fauna of the French Congo must be cited as evidence adverse to the conclusion that it is found throughout the Congoese district. At the same time the omission may be attributed merely to the scarcity of the animal.

That *F. serval* and *F. servalina* have been recorded from the same country is indisputable; but, so far as I am aware, there is as yet no convincing evidence that the two forms are found side by side on the same spot. Skins of both, for example, have been sent to Europe labelled 'Sierra Leone,' 'Uganda,' and 'Angola.' Such labels, however, are no proof that the two are found together. On the other hand, Mr. Spencer Shield (quoted by Dr. Sclater) speaks of the Serval as common in Angola and Loango. Bocage received the Serval from several places in Angola (Ambacca, Quillengues, and Huilla). Both these authors give different localities in Angola for *F. servalina*, and neither expresses a doubt as to the distinctness of the two forms. Finally Sir Harry Johnston states that the Serval is abundant in the Uganda Protectorate up to the verge of the Congo forest, though not within the forest; and he speaks in different terms of the distribution of the Servaline Cat within that country. This is clearly a question about which more evidence is required before a correct opinion can with certainty be arrived at; but as a working hypothesis it may be assumed that *F. servalina* inhabits the triangular area, or at all events the fringe of that area, whose angles are situated, broadly speaking, at Sierra Leone, Angola, and Uganda; and that the Serval is distributed in the countries lying to the north, east, and south of that area. Here and there it appears that the two 'forms' mutually encroach on each other's territories, without, however, actually meeting in the same places, each probably being addicted to a particular kind of country.

---

to prevent this statement and the one I have made from being necessarily contradictory. Some examples of *F. serval senegalensis* are, in a sense, intermediate in pattern between boldly blotched examples of typical or subtypical Servals and of *F. servalina*; but there is no doubt whatever as to which of the two forms they belong.

* The localities of this collector's material are, I understand, open to doubt.

† J. Sci. Lisboa (2) i. p. 176, 1890.

If in the future it be shown that the two live side by side in the same locality, the fact might be cited as evidence either of their specific distinctness or of their dimorphic nature. It will be opposed to the view that they are subspecific forms. The best evidence for the latter will be the discovery of truly intermediate types; and the best evidence for their dimorphism will perhaps be the occurrence of the two types in the same litter of kittens known to be the progeny of parents resembling each other in pattern.

The skins I have had an opportunity of examining seem to show that *F. servalina* is itself represented by geographical races. Of these I recognise four, namely, the typical race from Sierra Leone, a second from Monbuttu, a third from Uganda (Entebbe), and a fourth from Mombasa.

These may be diagnosed as follows:—

Subspecies SERVALINA Ogilby.

Ground-colour olive-yellow; fore part of shoulders, top and sides of neck unspotted. Behind the unspotted area the spots are at first faint but become gradually more and more distinct posteriorly along the back.

Loc. Sierra Leone. (Type, B. M. no. 55.12.29.412.)

The type is a native-prepared skin without the head. The two native-made skins, also headless, brought back by Winwood Reade and labelled Senegambia are much like the type, but one of them shows markings on the neck.

Subspecies PANTASTICTA, nov. (Plate XXXVIII. fig. 3.)

Differs from the typical *F. s. servalina* in having the neck (and also the head) distinctly streaked longitudinally and the shoulders as thickly and as distinctly spotted as the back and sides. Moreover, the ground-colour is of a richer yellow hue.

Loc. Uganda: Entebbe. (Type, B. M. no. 6.3.10.1, *E. A. Minchin.*)

A very beautifully marked example of this race, labelled "Uganda," was presented to the Society on June 4th, 1898, by Mr. F. G. Hall, and lived eight years in the Gardens.

This example is somewhat more richly coloured than the type from Entebbe, possibly because the latter is slightly more faded. The difference in tint between these Uganda specimens and the earlier procured examples referred to the typical subspecies may also be due to fading of the latter. On the other hand, examples of the true Serval from Uganda appear to be more richly tinted than those from Senegal; and the same may be the case with the Servaline Cats.

Subspecies POLIOTRICHA, nov.

F. servalina Thos. P. Z. S. 1888, p. 5.

Dorsal area olive-grey; sides of the body and thighs markedly greyish, the pale distal portion of the hairs being almost white instead of yellow as in the other subspecies; front of the fore and hind legs also less yellow; and on the sides of the body the stripes run more definitely into wavy longitudinal streaks, their arrangement being more regular than in the others. Head and neck distinctly streaked and shoulders spotted as in *F. s. pantasticta*.

Loc. Monbuttu. (Type, B. M. no. 87.12.1.5, *Emin Pasha*.)

Subspecies LIPOSTICTA, nov. (Plate XXXVIII. fig. 4.)

Distinguishable at once from the typical and other subspecies of *F. servalina* by the evanescence of the spots on the dorsal area of the body, at least the median third of the flat skin being practically self-coloured almost like that of *F. chaus*. Low down on the sides and on the white of the belly there are a few rather indistinct dusky spots. On the thighs and shoulders the spots appear at a somewhat higher level than on the body, and gradually increase in size and blackness towards the elbow and hock. The neck is at most very faintly lined, but there are practically no spots on the forehead or cheeks. The tail is confusedly spotted above proximally and marked with narrow bars distally. The general colour is a tawny yellow with an ashy tinge.

Loc. Mombasa.

A single young female specimen was presented to the Society by the Rev. Ernest Millar on June 23rd, 1897 and died on the 14th of July of the same year. The flat skin from the ears to the roots of the tail measures 23 English inches. The skull shows that the animal was just changing its teeth. The permanent canines and carnassials of the upper jaw are half through, the molars are fully formed; the milk carnassials are still in place. In the lower jaw the carnassials (molars) are in place, and the two milk premolars still present on one side, though on the left the anterior is gone: the canines are both half up. In both upper and lower jaws the permanent incisors appear to be fully formed. The length of the lower permanent carnassial is 10 mm., of the upper 13.

It is possible that this specimen was not actually caught at Mombasa. Since Mombasa, however, was the port of shipment, it is probable that the Cat came from British East Africa, perhaps from some place on the Mombasa to Uganda Railway.

The characters of the four subspecies may be tabulated as follows:—

a. Back from behind shoulders to root of tail without distinct spots or stripes .... *liposticta*.

a[1]. Back thickly and distinctly spotted, with a narrow median spinal stripe usually traceable.

b. Fore part of shoulders, sides and upper surface of neck practically unspotted and unstriped .... *servalina*.

b[1]. Fore part of shoulders as thickly spotted as the back; upper side of neck longitudinally streaked.

c. Sides of the body and thighs with ground-colour a rich tawny yellow .... *pantasticta*.

c[1]. Sides of the body and thighs with ground-colour decidedly grey .... *poliotricha*.

On FELIS SERVAL *Schreb.* (Plate XXXVIII. figs. 1, 2.)

Subsp. SENEGALENSIS Lesson. (Plate XXXVIII. fig. 1.)

Felis senegalensis Lesson, Mag. Zool. 1839, pl. x.

Matschie cites *F. senegalensis* as a synonym of the earlier described *F. galeopardus* of Desmarest (Mammalogie, pp. 227–228, 1820). Judging from the figures of the types of the two forms, I should say this opinion is untenable. In both there are very definite tolerably widely spaced cervical and dorsal stripes, but whereas in *F. senegalensis* the sides of the body are covered with numerous small rather close-set spots, in *F. galeopardus* the spots are larger and much less closely set. This difference, coupled with the fact that the locality of the type of *F. galeopardus* is unknown, makes the acceptance of Matschie's opinion impossible without some evidence to support it. For the type of *F. galeopardus* I select the specimen represented by the figure in F. Cuvier's Hist. Nat. Mamm. i. 1818. This figure and the accompanying text were published two years before the issue of Desmarest's volume, and Desmarest not only quotes them but inserts Cuvier's name as his authority, at the end of the description of *F. galeopardus*. A reduced copy of Cuvier's figure is published in Jardine's Nat. Libr., Felinæ, pl. xxiv., 1837, and in Mr. Lydekker's volume on Cats in Lloyd's Nat. Hist. pl. xiv., 1896.

Of *F. serval senegalensis* there is a good photograph in Sir Harry Johnston's 'Liberia,' ii. p. 701, 1906. The numerous round and close-set spots forming 8 or 9 rows from belly to back on each side are very clearly shown. This example came from the Liberian border, presumably the northern border; and judging from the photograph the animal must have resembled very closely a specimen from Sierra Leone, now living in the Gardens, which was presented by Mr. Hudson with the example of *Felis aurata* above described (p. 659). It is important to record that this specimen lived in the Gardens about a year. It grew a great deal, but did not appreciably alter in colour or pattern.

F. s. senegalensis may be said to have about 17 or 19 rows of spots across the body dorsally from belly to belly, including the median spinal and the two dorso-lateral stripes. The rows, however, are extremely difficult to count, and it is easy to decrease or increase the total by one or two on each or either side. Nevertheless in the main it is true that this subspecies has smaller and considerably more spots than Servals occurring in certain other parts of Africa. In some of the latter the spots are much more elongate and their serial arrangement much more evident than in *F. s. senegalensis* (Plate XXXVIII. fig. 2).

The number of rows also is less on the whole, amounting to only about 15 *, regarding the spinal stripe, which is sometimes doubled, as one. Now Matschie's alleged species *F. togoensis* is said to have 20–24 rows of spots, those on the back being

* Matschie says 12–16 (SB. Ges. Nat. Fr. Berlin, 1895, p. 110).

arranged in 5 or 7 narrow longitudinal stripes. Thus, so far as the numbers of rows are concerned, *F. s. senegalensis* is intermediate between *F. togoensis* and the typical form. The definite formation of as many as five dorsal rows is very unusual. Three is the typical number. But the figure of the type of *F. s. senegalensis* shows on the left side *two* stripes below the spinal stripe and above the irregularly arranged spots. Inferentially therefore, this specimen resembled at least one of those described as *F. togoensis* in having a total of five dorsal stripes.

F. togoensis is also said to be darker coloured than *F. s. senegalensis* and *F. s. serval.* In Jan. 1905, a Serval kitten from Upper Nigeria was presented to the Society by Capt. B. A. Rice. The skin of this specimen is decidedly darker and richer in hue than the typical and Senegalese Servals I have seen. In other respects it seems to resemble the example of *F. s. senegalensis* figured by Sir H. Johnston, the spots being small, numerous, close-set and irregularly disposed, there being only three definite dorsal stripes, and perhaps about eight rows of spots in addition on the sides and belly. These facts show that there is a complete gradation between *F. togoensis* and other true Servals in all the characters mentioned by Matschie as distinctive of his species. *F. togoensis*, therefore, can at most be given only subspecific rank.

On FELIS OCREATA *Gmelin.*

Felis ocreata Gmelin, Anh. Bruce Reisen (trans. by E. W. Cuhn), ii. p. 27 (1791); H. Schwann, Ann. Mag. Nat. Hist. (7) xiii. p. 421 (1904).

Felis lybica de Winton in Anderson's Zoology of Egypt, Mammalia, p. 117 (1902).

Subsp. UGANDÆ Schwann.

Tom. cit. p. 424.

There is a single specimen of *F. ocreata* now living in the Gardens, which is no doubt referable to this local race. It was taken as a kitten at Neari, north of Fort Hall, in Uganda, and is the property of Miss Winifred Edwardes.

The general colour is a stone-grey. The stripes on the body are scarcely defined but show up in certain lights as very pale yellowish-brown bands. On the legs they are much more distinct, the two internal brachial stripes being black and conspicuous. The distal portion of the tail is also striped with black.

Subsp. CAFRA Desm.

Felis cafra Desmarest, Encycl. Méthod., Mamm. Suppl. 1822, p. 540 (and of subsequent authors).

Early in the present year the Society received from Mr. A. W. Guthrie, C.M.Z.S., of Port Elizabeth, a young example of this race, which unfortunately died a few weeks after arrival.

I am compelled to agree with Mr. Schwann that the name *obscura* Desm., admitted by Dr. Elliot to be the earliest name for this Cat and adopted for it by Mr. de Winton (Anderson's 'Mammals of Egypt,' p. 175), should not supersede *cafra*. It was probably based upon a melanistic specimen of the domestic cat described as *F. torquata*, or upon a mongrel between that breed and *F. ocreata cafra*. Mr. Schwann's reasons for rejecting Mr. de Winton's view are not, however, in my opinion convincing. He lays stress upon the fact that the cat was compared to a domestic cat in size and was too numerously and conspicuously striped for *F. o. cafra*. The first reason may be met by saying that the animal was young; and the second by the statement that Cuvier's figure of the type does not bear out the belief in the numerical excess of the stripes over those of *F. o. cafra* *.

It seems to me that the type of *F. obscura* might have been a young, somewhat unusually well-striped melanistic specimen of *F. cafra*, in which the stripes would naturally show up as black bars, were it not that Cuvier's figure proves that the tail was strongly banded to the base. This is a character in which domestic cats of the *torquata*- and *catus*-breeds often, though not invariably, differ markedly from examples of *F. ocreata* and *F. sylvestris*, in which the caudal stripes are usually only well developed at the distal end of the tail. Another feature of *F. obscura* upon which Cuvier laid stress, remarking that he had never seen it in the Red-eared African Cats (*F. ocreata*), is the presence of two distinct stripes on the cheek. When the stripes are retained in domestic cats, these cheek-stripes are always visible. But since they are also present in examples of *F. o. cafra*, no great importance can be attached to them in this connection.

The colour of the coat, the banding of the tail, and Cuvier's remarks about the tameness of the Cat when at liberty, are the principal reasons which make the substitution of *obscura* for *cafra* hardly defensible.

On FELIS NIGRIPES *Burchell.*

Felis nigripes Burchell, Travels, etc. ii. p. 592 (1824); Matschie, SB. Nat. Fr. Berlin, 1894, p. 258; W. L. Sclater, Fauna of S. Africa: Mammalia, p. 40, fig. 11 (1900).

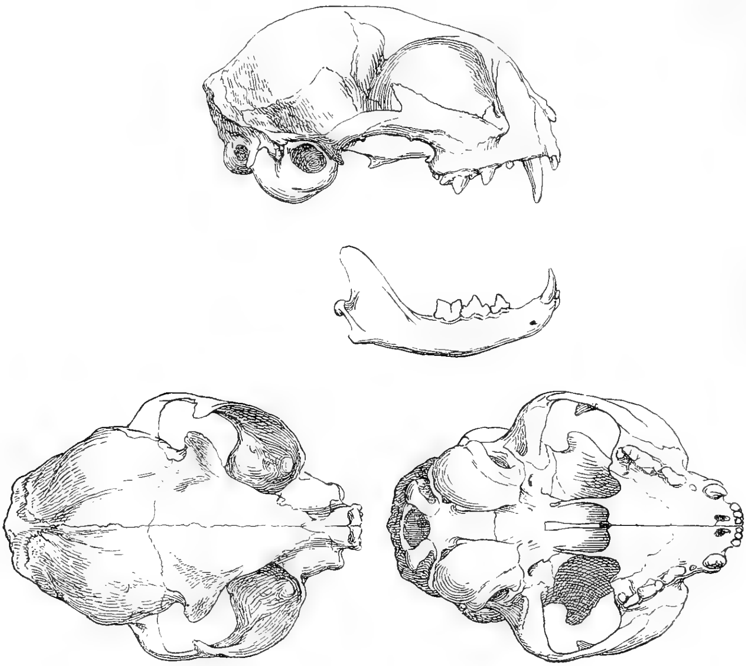
Two examples of this interesting little Cat, the smallest of all the species of *Felis*, were presented to the Society in May 1906 by Mr. A. W. Guthrie, C.M.Z.S., of Port Elizabeth. They were procured from a dealer who declared they came from the Zambesi. It would be unsafe to place any great reliance upon this statement.

Apart from colour and pattern (text-figs. 177 & 178, pp. 672 & 673) the living animal is remarkably like a diminutive domestic cat, especially about the head and face. The legs, however, are relatively shorter, and the paws exceptionally small and dainty. The iris of the eyes is yellowish green

* The early literature of *F. obscura* is as follows:—"Le chat noir du Cap," F. Cuvier, Dict. des Sci. Nat. viii. p. 222 (1817); *F. obscura* Desmarest, Encyclop. Méthod., Mamm. p. 230 (1820); F. Cuvier, Hist. Nat. Mamm. ii. pl. 128 (1826).

and the pupil contracts to a vertical slit under strong light. Except in colour, and to a less extent in pattern, this Cat bears no resemblance to the Serval as has been stated by Mr. W. L. Sclater.

Text-fig. 176.



Skull of *Felis nigripes*.
Lateral, dorsal, and ventral views.

Broadly speaking, the skull (text-fig. 176) is like that of *F. sylvestris* and *F. ocreata*. When resting on the tips of the canines and on the bullæ, its highest point is on the anterior portion of the parietals. From that point the top of the cranium descends somewhat abruptly posteriorly, while anteriorly the frontals form a more gradual descent towards the muzzle. The nasal bones and facial portion make an abrupt descent from the forehead, the plane of the nasals being nearly parallel to the line of the anterior border of the orbit. The postorbital processes are short but broad and laminate. The posterior portion of the nasals is strongly compressed. The zygomatic arches are widely expanded in their anterior or orbital moiety. The under side of the skull is remarkable for the great size of the auditory bullæ; the greatest length of a bulla is equal to the distance between its anterior edge and the palatal rim of the posterior nares; also to the width across the occipital condyles and to the distance between the posterior edge of the canine and the posterior edge of the last cheek-tooth (m^1) of the maxilla. The auditory meatus also is correspondingly large.

So far as dentition is concerned, the skull presents a marked difference from those of *F. ocreata* and *F. sylvestris* in the reduction of the inner cusp of the maxillary carnassial to a small rounded lobe.

The following measurements will show some other differences between the skulls of examples of *F. nigripes*, *F. ocreata*, and *F. sylvestris*.

	F. nigripes.	*F. ocreata* (Suakim).	*F. sylvestris* (Scotland).
Basal length	60	81	82
Breadth of cranium	39	47	47
" behind postorbital processes	30	36	34
" across zygomata above posterior cusp of upper carnassial.	48	61	61
" across occipital condyles	19	24	24
Length and breadth of auditory bulla	18; 15	19; 17	18; 13
Length of palate	25	35	36
Length and height of auditory meatus	8·5; 6	9; 6	7; 4
Length of 2nd and 3rd maxillary premolars	14	18	17
" of 3rd maxillary premolar (upper carnassial)	9·5	12	12
" of 1st mandibular molar (lower carnassial)	6·5	8·5	8

The chief differences between the skulls of *F. nigripes* and *F. ocreata* may be tabulated as follows *:—

a. Inner cusp of maxillary carnassial large; length of auditory bulla much less than the length of the space between its anterior border and that of the mesopterygoid fossa and about equal to the length of the 2nd and 3rd maxillary premolars, less than the width across the occipital condyles ... *ocreata*.

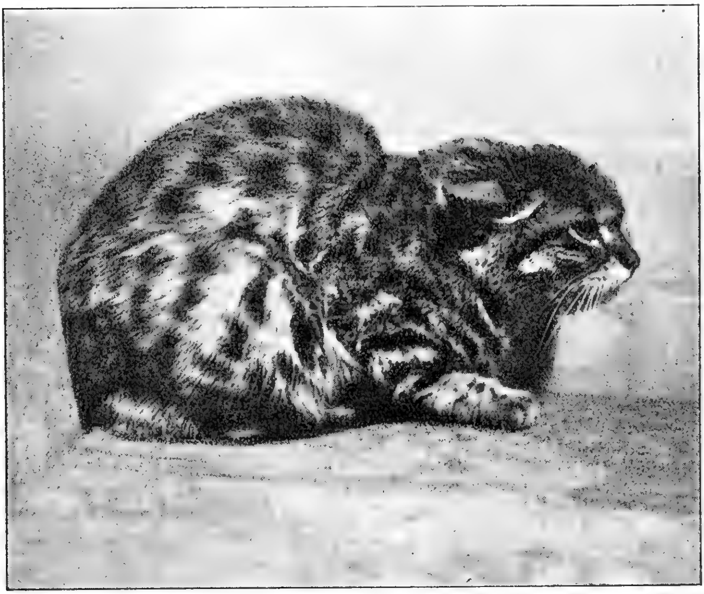
a'. Inner cusp of maxillary carnassial reduced to a small lobe; length of auditory bulla about equal to the length of the space between its anterior border and that of the mesopterygoid fossa and to the distance between the socket of the canine and the posterior border of the 2nd premolar of the maxilla and to the width across the occipital condyles .... *nigripes*.

The diminutiveness of *F. nigripes* suggests that it is a dwarfed species; and its resemblance to *F. ocreata* further suggests that it

* Mr. W. L. Sclater says that the skulls of *F. nigripes* and *F. ocreata cafra* resemble each other except in the matter of size. It seems hardly likely that the skull and teeth of *F. nigripes* vary to the extent necessary for the reconciliation of this statement and that made above embodying the differences. Hence it must be supposed that Mr. Sclater never saw the skull of this species, but was merely quoting Dr. Matschie's remarks.

is a dwarfed and otherwise modified Cat of the last-mentioned type. It is not therefore a matter for surprise that in many of the characters in which the skull differs from that of *F. ocreata*, it shows an approximation to features presented by the young of that species. This is especially shown in the relatively larger brain-case and auditory bullæ. The skull of a kitten of *F. ocreata* resembling that of *F. nigripes* in size differs most markedly from the skull of *F. nigripes* in that the plane of the nasals is in almost the same line as that of the anterior portion of the frontals, the fall of the face beginning only a little in front of the fronto-parietal suture.

Text-fig. 177.



Felis nigripes.

Photograph of the living animal in summer coat with markings well-defined.

It may further be noted as an interesting fact that the auditory bullæ and auditory orifice in *F. nigripes* are actually nearly as large as in an adult of *F. ocreata*. The explanation of this is to be sought, I suspect, in the relative defencelessness of *F. nigripes*, which requires an acuter auditory sense than *F. ocreata*, for the purpose of evading enemies.

The following description of this species is taken from the skins in the British Museum and from the two specimens in the Society's collection.

General colour creamy or greyish fawn on the neck, sides and dorsal surface of the body, the median dorsal area darker than the sides, the hair on the back longer and forming a sort of short

Text-fig. 178.

Felis nigripes.
Flat skin from specimen in winter coat with obscure markings.

spinal mane especially upon the lumbo-sacral area as in *F. ocreata* and *F. chaus*. Head "rabbit" grey, indistinctly or distinctly striped or spotted on the crown, rarely so on the forehead, where the stripes are evanescent. Ears short, of about the same size as in the domestic cat, coloured like the head; not apically pencilled. Stripes on the occiput black; on the nape often broken up and fading to rusty brown; those on the sides of the neck especially tending to assume a rusty hue. In front of the shoulder, short stripes extend obliquely downwards and forwards on to the neck, two of them, better marked than the rest, forming collars. A third collar crosses the interramal area, and there are at least two well-marked stripes on the cheeks. The pattern on the body consists for the most part of spots sometimes black, sometimes suffused with brown. On the dorsal area the arrangement of the spots is sometimes more or less longitudinally linear; and on the sides of the thorax two or three oblique stripes are sometimes formed. The tail has a median dark blackish-brown stripe and at its distal end about three transverse black stripes, incomplete below, and a black tip. The ventral surface from the chin to the anus, and the insides of the limbs and under side of the tail are white or whitish. The spots on the belly are large and black; also on the shoulder and thighs they are blacker as a rule than on the body. The outer side of the legs is creamy fawn; the fore leg is encircled at the base with two very broad black stripes; the sole of the foot up to the wrist is black; the paw is speckled above with black; there is an incomplete stripe above the wrist in front. The hind leg has two strong black stripes above the hock and is black behind from the pads up to the hock. The under-fur is almost sooty-black on the dorsal area, but a paler more slate-grey on the sides.

Loc. Bamanguato (*F. C. Selous*); Deelfontein (*Claud Grant*); Vredefort Road, Orange River Colony (*Barrett Hamilton*). Previously recorded from Bechuanaland and the Kalahari Desert.

The skins from different localities mentioned above differ somewhat from each other; but there is not as yet sufficient material, in my opinion, to warrant the naming of local races.

The following measurements in mm. have been taken from animals in the flesh, with exception of no. 4.

	Total length.	Head and body.	Tail.	Hind foot.	Locality.
1	528	358	170	92	Deelfontein (B.M.)
2	525	368	157	85	" "
3	506	337	169	81	(? Zambesi. Zool. Soc.)
*4	650	500	150	80	(? loc. S. Afr. Mus.)

* These measurements are recorded by Mr. Sclater, presumably in inches, and are here reduced to millimetres. They were taken from a mounted specimen. Stretching of the skin probably accounts for the marked disproportion in length between the tail and the head and body.

On FELIS CARACAL *Güld.*

At the present time there are four Caracals living in the Gardens, an adult pair from South Africa presented by Col. Sloggett, D.S.O., R.A.M.C., a young female from Jebba in Nigeria presented by Mr. E. Lort Phillips, and a young male presented by Sir George Denton from Senegal. The South African animals have shorter tails and are rather darker and greyer in tint than those from North-western Africa; but the latter difference may be merely a question of age. A young specimen brought by Capt. Rice from Lake Chad was also more richly tinted than those presented by Col. Sloggett. But the Society's material does not justify the classification of African examples of this species into more than one subspecies.

The example brought by Capt. Rice was extraordinarily tame, although about half-grown, and played about the office with a piece of string exactly like a kitten and allowed itself to be handled without attempting to scratch or bite. The specimen sent by Sir George Denton, on the contrary, was, Dr. Hopkinson, D.S O., tells me, absolutely savage from its earliest days, although it was taken when about a month old and always kept on a chain. The interest of these facts lies in the conclusion they enforce that fierceness in animals of this kind is a matter of individual temperament, and not a specific characteristic.

Dr. Hopkinson also tells me that Caracals appear not to be known actually in the Gambia. The species is at least unknown to the natives, and there is no name for it in any of the native languages.

On FELIS PARDUS *Linn.*

Subsp. LEOPARDUS Schreb.

Felis leopardus Schreber, Säug. iii. p. 387, pl. ci. (named on plate), 1777; Erxleben, Syst. Regni Anim. p. 509, 1777.

Both by Schreber and Erxleben the name *leopardus* was applied to West-African Leopards. Schreber gave the distribution as from Gambia to the Cape; but Erxleben restricted the locality to Guinea and the adjoining countries of Africa. Moreover his words "*corpore fusco maculis subcoadunatis nigris*" and "*maculis maxime approximatis*" forcibly suggest that he was acquainted with skins or living examples of the form he was describing. The so-called East-African Leopard cannot therefore be regarded as typical of "*leopardus*" as Mr. Lydekker maintained *.

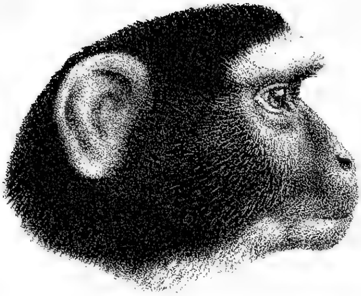
* 'Great and Small Game of India,' p. 297, 1900. The synonymy of some of the larger species of Felidæ is still somewhat confused. For instance, Dr. Neumann speaks of the Leopard of the Atlas as '*panthera*' (Zool. Jahrb., Syst. xiii. p. 552, 1900). Dr. Trouessart, on the contrary, applies the name '*panthera*' Erxl. to a Leopard inhabiting Persia, India and Ceylon (Cat. Mamm. Suppl. p. 268, 1904); and Mr. Lydekker used it for the Persian race which was subsequently named *tulliana*. It appears to me, on the contrary, to be evident that Erxleben gave the name *panthera* to the species that Schreber described as *uncia* (see Fischer, Syn. Mamm., Add. etc. p. 567=(367) 1830). At all events there are just as good, or as bad, reasons for holding that *panthera* was applied to the species we call the Snow Leopard or Ounce, and which Ehrenberg not unjustifiably named *F. irbis*, as for holding that *uncia* was applied to that species. The name *panthera* of Schreber must on Schreber's own citation be regarded as a synonym of *pardus* Linn.

Within the last few years the Society has received several examples both young and adult of this race—namely, two cubs of about a month old from Sierra Leone, presented by Major Pearce, R.A.M.C., F.Z.S., one half-grown specimen from Ashanti presented by Mr. R. Higham, and one full-grown animal from Jaman (Ashanti) presented by Mr. F. C. Fuller. All are very uniformly coloured, and are of a peculiar dusky shade which differs markedly from the golden tawny hue of most Indian specimens. This dusky effect is produced by a combination of two causes, namely by the greyer hue of the interspaces or ground-colour and by the closeness of the spots, the interspaces being narrower than the spots and forming what might be described as a relatively narrow reticulated pattern. Quite distinct in appearance from these West African Leopards is one now living in the Gardens, which was brought by Mr. F. H. Melland from the Luangwe Valley in N.E. Rhodesia (north of the Zambesi). This is of the yellow type, like typical Indian Leopards, but the pattern is less definite than in any of the Oriental and West African specimens now possessed by the Society, that is to say the component elements of the so-called rosettes are less consolidated. In this respect the specimen shows an approximation to the type of pattern observed in the Grahamstown Leopards recorded by Dr. Günther in the paper above referred to* (P. Z. S. 1885, p. 243, pl. xvi.; *id. op. cit.* 1886, p. 203, fig.).

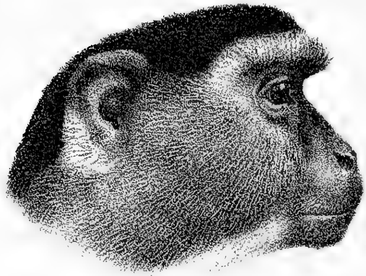
I do not think it is possible to find any one character for distinguishing the skins of African Leopards from those of Asiatic Leopards as a whole, unless it be that African Leopards are more closely spotted, especially upon the nape of the neck. It is not true, as has been stated, that they may be distinguished by the presence of rosette-spots upon the shoulders and neck in Asiatic animals, and of solid spots on those areas in African animals. Small rosette-spots are observable upon the neck of the Leopards from Jebba and Ashanti already mentioned; whereas in two examples from Ceylon and the Central Provinces of India, that were recently living in the Gardens, the spots on the neck were all solid.

African Leopards never apparently exhibit the large rosettes seen in some Asiatic animals, especially in the Chinese *Felis pardus fontanieri*. Some Asiatic Leopards indeed are almost, perhaps quite, intermediate in pattern between some African Leopards and Jaguars. On geographical grounds one would expect this to be the case; for the Jaguar is beyond all doubt in my opinion an American Leopard, in the sense that the Leopard and the Jaguar are much more nearly related to one another than

* I do not know by what racial title this Leopard from N.E. Rhodesia should be known. Neumann has given the subspecific name *suahelica* to what he calls the large spotted E. African Leopard of which he saw skins from North Ugogo, Uganda, and elsewhere. This description does not, however, apply to Mr. Melland's specimen. Nor do the characters of the latter animal agree with those of *F. pardus nimr* Ehrenb., which according to Neumann is a grey form inhabiting the coast of the Red Sea, and resembling the Persian *F. pardus tulliana* in tint (Zool. Jahrb., Syst. xiii. p. 552, 1900).



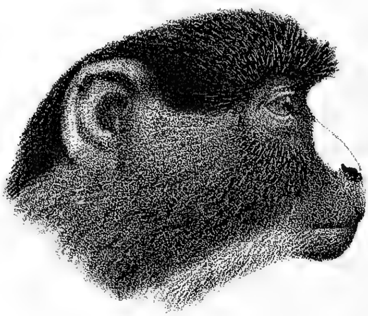
1.



2

3.

4

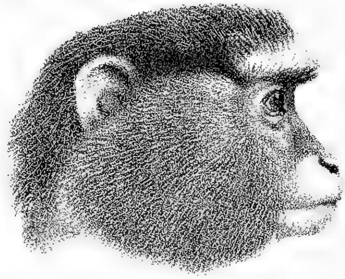


5.

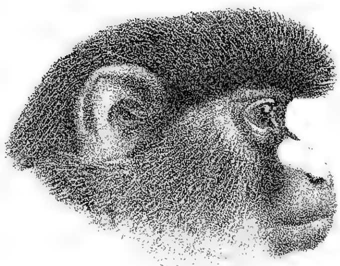
H.Goodchild del. et lith. Huth imp.

SPECIES OF CERCOPITHECUS.

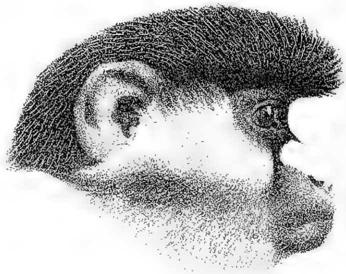
1.



2.



3.



4.

5.

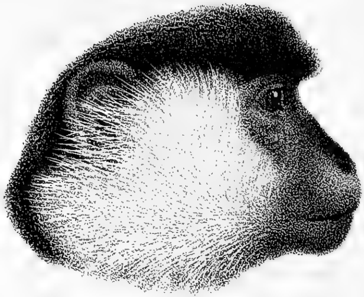
6.

H. Goodchild del et lith.

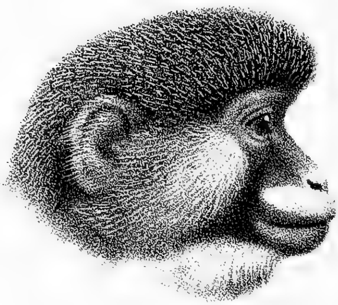
Huth imp.

SPECIES OF CERCOPITHECUS

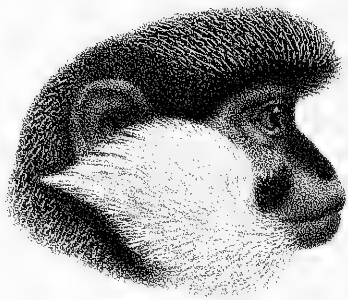
1.



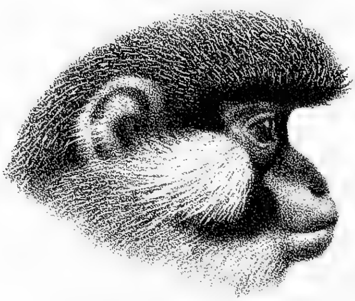
2.



3.



4.



5.

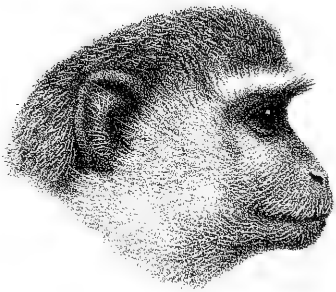
6.

H. Goodchild del. et lith. Parker & West imp.

SPECIES OF CERCOPITHECUS.

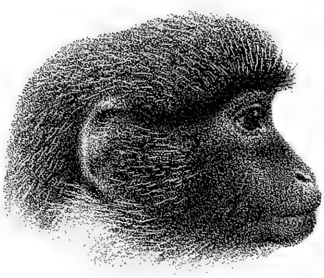
1.

2.

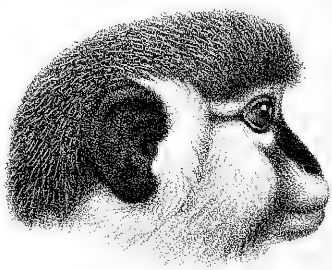


3

4.



5



6

H. Goodchild del. et lith.

Parker & West imp.

SPECIES OF CERCOPITHECUS.

either is to the Puma (*F. concolor*), Lion (*F. leo*) or Tiger (*F. tigris*).* This opinion, obviously suggested by the pattern of the skin, is confirmed by the similarity in voice between the two species. The roar, which is quite unlike that of a Lion or Tiger, may be described as a series of hoarse barking coughs, an interval of about one second separating each expiratory effort. It very much resembles the sound produced by sawing a piece of thin wood with a coarse-toothed saw. In a female Jaguar now in the Gardens the roar is less deep-toned, and its repetition is more rapid than in a female Nepalese Leopard, but whether these differences obtain throughout the species or are merely individual, I do not know. In any case there is no mistaking the fundamental resemblance between the sounds. And I do not think there can be any doubt that the existing Leopards and Jaguars are descended from a common stock which in comparatively recent times ranged sufficiently far to the north to pass from Asia to North America or *vice versâ*.

This explanation is in keeping with the greater resemblance, above referred to, that obtains in pattern between Jaguars and North Asiatic Leopards than between Jaguars and African Leopards. And it may be noted that the Leopard which is the least like the Jaguar in pattern is the one that is furthest removed from it geographically, that is to say the form from Grahamstown named *Felis pardus melanotica* by Dr. Günther.

EXPLANATION OF PLATE XXXVIII.

Fig. 1. ***Felis serval senegalensis*** Less. Skin of a specimen from Sierra Leone, p. 667.
Fig. 2. ***Felis serval*** Schreb. Skin of large spotted form from Uganda, p. 667.
Fig. 3. ***Felis servalina pantasticta***, subsp. nov. Skin of specimen from Uganda, p. 665.
Fig. 4. ***Felis servalina liposticta***, subsp. nov. Skin of type labelled "Mombasa," p. 666.

8. A Monographic Revision of the Monkeys of the Genus *Cercopithecus*. By R. I. Pocock, F.L.S., Superintendent of the Gardens.

[Received May 28, 1907.]

(Plates XXXIX.–XLII.†, and Text-figures 179–193.)

Introduction.

The name *Cercopithecus* was first used in a binominal sense by Erxleben in 1777 for all the long-tailed Monkeys of the Old World known up to that time. Subsequent elimination of some of the species contained in it to form the genera *Colobus*, *Cercocebus*, *Macacus*, and others in the middle and early half of the last century gradually gave to the genus its present significance, and reduced the species referred to it by Erxleben to the following nine:—*diana*, *mona*, *sabæa*, *patas*, *nictitans*, *petaurista*, *talapoin*, *cephus*, and *roloway*.

* I refrain from putting the Ounce (*F. uncia*) in this category, having had very few opportunities of studying this species either alive or dead.

† For explanation of the Plates, see pp. 745–746.

Of these *talapoin* was made the type of a separate genus, *Miopithecus*, by Is. Geoffroy St. H. (C.R. Acad. Sci. xv. p. 720, 1842), and this author legitimately selected as the type of *Cercopithecus* the species named *callitrichus*, which is the same as *sabæus* of Erxleben (Cat. Méthod. Mamm., Primates, p. 18, 1851).

Since that date the genus *Cercopithecus* has been broken up into a considerable number of named minor groups, notably by Reichenbach and Trouessart. No type species were intentionally indicated by the authors who named these groups or subgenera. One only, namely *Cynocebus*, was based upon a single species. Its type therefore was fixed from the beginning. Moreover, in three others, namely *Mona*, *Petaurista*, and *Diana*, the type was, *ipso facto*, indicated to start with by the adoption for the subgenus of the name of one of the species comprised in it. Of the majority, embracing more than one species, the types have up to the present remained unsettled; and since it is now considered expedient to fix the type species of all genera and subgenera in Zoology, I have attempted to revise the subgenera of *Cercopithecus* for that purpose and have selected a type species for each out of the residuum of species remaining from the process of elimination practised by authors who have preceded me.

The results arrived at are briefly expressed in the following list:—

CALLITHRIX Reich.[1], 1863 (preoccupied). Type by selection *C. callitrichus* (=*sabæus* Linn.).

CERCOPITHECUS Erxl., 1777. Type by selection *C. callitrichus* (=*sabæus* Linn.).

CHLOROCEBUS Gray[2], 1870. Type by selection *C. sabæus* Linn.

CYNOCEBUS Gray[2], 1870. Type ab initio *C. cynosurus* Scop.

DIADEMIA Reich.[1], 1863. Type by elimination and selection *C. leucampyx* Fisch.

DIANA Trouess.[3], 1897. Type by tautonymy *C. diana* Linn.

ERYTHROCEBUS Trouess.[3], 1897. Type by selection *C. patas* Schreb.

MIOPITHECUS Geoffr., 1842. Type ab initio *C. talapoin* Schreb.

MONA Reich.[1], 1863. Type by tautonymy *C. mona* Linn.

OTOPITHECUS Trouess.[3], 1897. Type by selection *C. pogonias* Benn.

PETAURISTA Reich.[1], 1863. Type by tautonymy *C. petaurista* Schreb.

POGONOCEBUS Trouess.[4], 1906. Type *C. diana* Linn., by substitution of *Pogonocebus* for *Diana* Reich., preoccupied.

RHINOSTICTUS Trouess.[3], 1897. Type *C. petaurista* Schreb., by substitution of *Rhinostictus* for *Petaurista* Reich., preoccupied.

[1] Reichenbach, Die volls. Nat. Affen, pp. 105–122 (1863).
[2] Gray, Cat. Monkeys B.M. (1870).
[3] Trouessart, Cat. Mamm. i. pp. 16–22 (1897).
[4] Trouessart, Cat. Mamm. Suppl. pp. 10–15 (1906).

The selection by Is. Geoffroy St. H. of *callitrichus* (=*sabæus*) as the type of *Cercopithecus* rendered abortive Gray's action in assigning the name *Cercopithecus* to other species unrelated to *sabæus*. Similarly W. L. Sclater's* selection of *mona* as the type of that genus cannot be entertained, both for the above-given reason and also because *mona* had been eliminated by Reichenbach as the type of his section *Mona*.

Although I have thus endeavoured to show to what sections of the genus *Cercopithecus* the various extant subgeneric names must be applied, I have done so, not because I think the sections have generic or subgeneric value, but simply because the names have been proposed by earlier authors. The application of subgeneric names to these sections is at present, I think, premature, because they rest almost wholly upon colour-characters; and if the system be adopted with consistency, it will be necessary to introduce additional names to emphasize the isolation of certain other species, such as *C. neglectus*, *C. l'hoesti*, and possibly *C. nigroviridis*.

The groups, moreover, are of unequal value. The differences, for example, between *C. petaurista* and *C. ascanius* or *C. signatus*, are, I think, of as much importance as those that separate any of the species referred to the three sections combined, named after *nictitans*, *leucampyx*, and *albogularis*—perhaps, indeed, of more importance.

One group, however, stands out from the rest and might perhaps with advantage be given full generic status. This is the group name *Erythrocebus*, typified by *patas*. The living animals differ markedly from other species, not only in colour, but in form. They are slender Monkeys standing high on the legs, the fore legs being particularly long as compared with those of other species, which are heavily built and low on the fore legs. A comparison between them forcibly suggests the differences in aspect between a Chitah and the larger species of *Felis* of about the same size, such as a Puma or a Leopard; and I suspect that *C. patas* is more terrestrial and less arboreal than the other members of the genus *Cercopithecus*.

I regret that lack of proper material has prevented me making use of skull-characters. To work the genus from the craniological standpoint requires a series of skulls of both sexes at various ages of development of each species, so that the extent of the variation in individuals of the same age and of different ages may be ascertained. The material for this is inadequate; and since the measurement and description of such skulls as I have seen would have doubled my work and inordinately added to the length of this paper, without yielding commensurate taxonomic results, I have been compelled to abandon, at all events for the present, all consideration of cranial characters.

One great systematic difficulty that I have had to face, and in

* 'Fauna of S. Africa': Mammals, i. p. 5 (1900). See also Palmer, 'Catalogue of the Genera of Mammalia' (1904).

many cases to leave unsatisfactorily settled, is the decision as to the status, whether specific or subspecific, that should be given to certain forms. This is an extremely difficult point, and one about which probably no two authors will agree. I suspect that most of my present day colleagues will think that I have been too lavish with subspecies, and will consider that the higher rank should have been assigned to them in most cases. Personally, I doubt if in all instances I have gone quite far enough in reducing species to subspecific level. These, however, are relatively unimportant points which future investigation alone can settle.

An interesting phenomenon connected with the coloration of the species of this genus is the frequency of the interchange of the three colours white, red, and black. For example, in *C. erythrogaster* the nose is said to change from black to white during growth. In *C. patas* I have reason to think that the lips, and in some cases the nose, turn from black to white and the limbs from red to white as age advances. In *C. sclateri* the nose-spot is white; in *C. erythrotis* it is red. In *C. burnetti* the belly is white; but in the closely related *C. grayi* it is yellowish red. In *C. petaurista* also it is white, but in *C. erythrogaster* it is red. In *C. kandti* the underside is red; in *C. leucampyx* it is black. In *C. diana* the thighs are rusty-red inside; in *C. roloway* they are white or yellow. In *C. cephus* the tail may be red or coloured like the back. Similar phenomena may be observed in the colour of the hairs on the ear in closely related species; and the brow-band similarly may be black, white, or red.

The material I have had at my disposal has been the skins in the collection of the Society and the examples living in the Gardens during the past four years, most of which were deposited for scientific work of this kind by the Hon. Walter Rothschild. I cannot overestimate the help these specimens have been to me; and my thanks are due to Mr. Rothschild for allowing me to make full use of them. I am also greatly indebted to Sir Ray Lankester and Mr. Oldfield Thomas for lending me the invaluable collection of skins in the British Museum, and especially to Mr. Thomas for giving me the freest possible access at all times to the collection under his charge. Without this privilege and help my undertaking would have been ten times more difficult, perhaps indeed quite impossible.

The two most recent monographs of this genus were those by Dr. P. L. Sclater in the 'Proceedings' of this Society for 1893, pp. 243–258, and by Dr. H. O. Forbes in Allen's Nat. Libr., Monkeys, ii. pp. 41–83, 1894. Since that date a considerable number of species have been added, principally by Dr. Matschie, Dr. Neumann, and Mr. Oldfield Thomas. References to the literature relating to these will be found incorporated in the text that follows.

Analytical Key to the Groups of Species.

a. Prevailing colour nearly brick-red; limbs below elbow and knee white in adult; skin of face and of ears pale flesh-coloured. PATAS-group (p. 742).

a'. Colour not brick-red; limbs below elbow and knee not white; face and ears never wholly pallid.

b. Long snow-white uprunning whiskers associated with a blackish or dark red belly.

c. A white brow-band; markedly white chest and inside of fore limbs; a tuft of hair on the chin and a white stripe on outside of thigh. DIANA-group (p. 682).

c'. No white brow-band; chest not wholly white and inside of fore limbs not white; no tuft on chin and no stripe on thigh.

d. Belly blackish and the same colour as the limbs; top of head blackish, finely speckled, not encircled ... L'HOESTI-group (p. 714).

d'. Belly and chest red, differing from the limbs in colour; top of head encircled with black and mostly golden green. ERYTHROGASTER-group (p. 715).

b'. Whiskers variously coloured, when white and uprunning associated with a white or whitish under side.

e. A white cordate nasal spot accompanied by a white or greyish-white under side and inside of limbs; under side of tail white and strongly contrasted in tint with the upper side, at least proximally. PETAURISTA-group (p. 717).

e'. Nasal spot, when present and subcordate not accompanied by white on the under side of the body and tail and inside of the limbs.

f. A very distinct patch of yellow or greyish-yellow hair on the cheek defined by a black stripe above and below. CEPHUS-group (p. 721).

f'. On the cheek no distinct patch of yellow hair defined above and below by a black stripe rising respectively from the brow and upper lip.

g. Upper and lower lips pink and contrasted with the slate-blue hue of the rest of the face; white, yellow, or red colour of the under side sharply contrasted, especially on the fore limbs, with the black or speckled upper and external areas; (arms almost always black) .... MONA-group (p. 708).

g'. Face not so coloured; colour of underside and of inner side of limbs not so sharply contrasted.

h. External surface of arms black or darker than back; under side dusky or black.

i. Summit of head with large red brow-band followed by a jet-black transverse stripe; a white beard, whitish thigh-stripe; two inches at base of tail sharply contrasted with the rest, which is black .... NEGLECTUS-group (p. 684).

i'. Summit of head not so coloured; no white beard or thigh-stripe; no sharp contrast in colour at base of tail.

j. A very conspicuous white patch on the nose. NICTITANS-group (p. 695).

j'. No conspicuous or isolated white nose-spot.

k. Black prevailing on head, nape, shoulder, belly, and thighs; when the head is strongly speckled the belly and thighs are black, when the belly and thighs are speckled the head is black, except for the brow-band; (belly rarely red) .... LEUCAMPYX-group (p. 687).

k'. Black absent or at least not dominant on the above-mentioned areas; back usually reddish or yellowish. ALBOGULARIS-group (p. 699).

h'. External surface of arms not black, sometimes the same colour as the body, usually rather paler and greyer.

l. Face almost always black, rarely mottled or freckled with pigment; whiskers usually growing upwards and backwards over the ear .... ÆTHIOPS-group (p. 725).

l'. Face particoloured, pallid, with black nose and lips. TALAPOIN-group (p. 740).

The DIANA-group.

Pogonocebus Trouess., 1906.

Face black, clothed with black hairs, which spread on to the cheeks, brows, and chin; a narrow white brow-band (diadem) on the forehead behind the superciliary black streak. A longer or shorter tuft of white hairs, forming a beard, on the point of the chin. A black band running from the corner of the eye to the ear. Ears black, scantily clothed with white hairs. Summit of head generally blacker than the body; nape of neck, shoulders, and sides of body dark iron-grey, speckled, the exposed portion of the hair being black with two or three whitish annuli. A rich brownish or blackish-red unspeckled band, broad and posteriorly expanding, extending from behind the shoulder to the root of the tail and sharply demarcated from the surrounding iron-grey tint. The posterior part of the jaw and of the cheek, the sides of the neck and throat, the chest as far back as the mammæ, and the whole of the front of the fore leg halfway between the elbow and the wrist white; the white everywhere, except on the lower arm, sharply defined from the surrounding black or grey. The white hair on the cheek forming uprunning whiskers which partially overlap the ear. The fore leg, except for the white strip above mentioned, black or nearly so both outside and inside. Area of chest behind mammæ and belly jet-black. Outer side of thigh greyish in front, white, yellow, or rufous behind up to the root of the tail; the rest, like the lower leg and foot, black. The black area on the thigh separated from the anterior grey area and from the red of the sacral area by a curving white stripe, which extends forwards and downwards from the upper rim of the ischial callosity. Inner surface of thigh and the whole of the pubic and anal areas white, yellow, or rusty brown. Tail black, with some reddish or grey hairs quite at the base.

Distr. W. Africa: Liberia to Nigeria.

The two known species belonging to this group may be distinguished as follows:—

a. Beard short, not more than an inch long, its basal portion covered to a great extent by black hairs; inner surface and back of thigh up to root of tail bright rusty brown .... *diana.*

a′. Beard from about two to three inches long, with scarcely any black hairs at the base; inner surface and back of thighs white, lemon- or orange-yellow .... *roloway.*

I have adopted Dr. Jentink's determination of these two species.

Cercopithecus diana Linn. (Plate XLI. fig. 1.)

Simia diana Linn. Syst. Nat. ed. 12, i. p. 38, 1766; Schreber, Säug. i. p. 94, pl. xiv., 1774.

Cercopithecus diana Jentink, Notes Leyden Museum, xx. p. 237, 1898 (nec auct. plurim.).

Cercopithecus diana var. *ignita* Gray, Cat. Monkeys Brit. Mus. p. 22, 1870.

Loc. Liberia.

CERCOPITHECUS ROLOWAY Schreber. (Text-fig. 179.)

Le Roloway ou la Palatine, Buffon, Hist. Nat. Suppl. vii. p. 77 and pl. xx., 1789.

Simia roloway Schreber, Säug. i. p. 109, named on p. 187 and pl. xxv., 1774.

Cercopithecus roloway Erxl. Syst. Regn. Anim. p. 42, 1777; Jentink, Notes Leyden Mus. xx. p. 237, 1898.

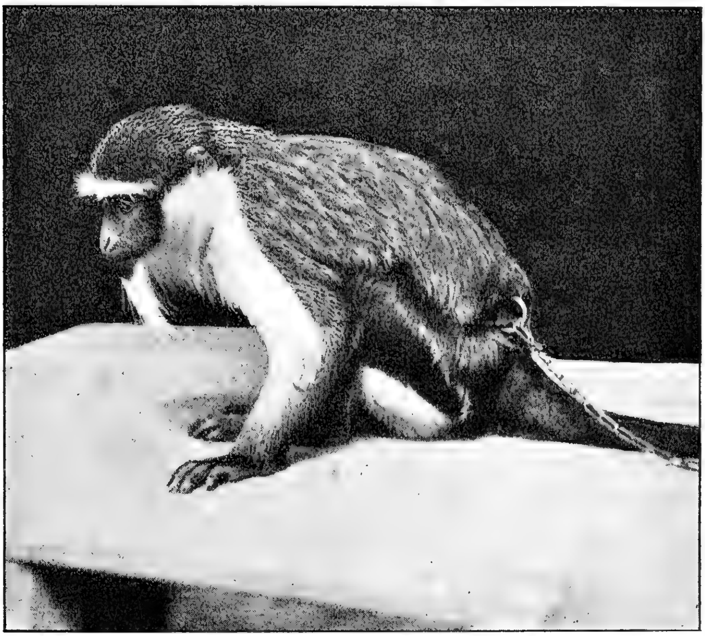
Cercopithecus palatinus Wagner, in Schreb. Säug. Suppl. v. p. 47, 1855.

Cercopithecus diana, auct. plurim., nec Linn.

Loc. Gold Coast and Guinea.

The British Museum has an adult male and female from Fantee (75.4.30.1–2). No exact locality is known for any of the Society's specimens.

Text-fig. 179.



Cercopithecus roloway Schreber.

(From a specimen living in the Society's Gardens.)

There is a possibility, though in my opinion it is remote, that the name *roloway* is here used in a wrong sense. In the original diagnosis and figure of this species the belly was described and represented as white. Both were taken by Buffon from a living specimen. But since Buffon's time no white-bellied Monkey of this group appears to have come to hand, although a very large number of examples have been brought to Europe from Guinea, the country whence the type of *C. roloway* came. The explanation of Buffon's assumed mistake is probably due, I think, to the fact that when one of these Monkeys is seated the white of the inside of the thighs is sometimes continuous with that of the chest and conceals the black of the belly, so that at a casual glance the whole of the under side appears to be white.

If in the future Buffon is proved to have observed correctly in the matter of the whiteness of the belly, the species which here passes as *C. roloway* will require a new name.

It may be added that young examples of *C. roloway* are usually coloured like the adults. Perhaps, however, the thighs get darker with age; or possibly specimens with white, lemon, or reddish thighs represent distinct local races. I have not seen sufficient localised material to determine this point. One young example, now living in the Gardens, had no trace of red on the back when first received, but subsequently acquired it, and differs in no respect now from typical specimens.

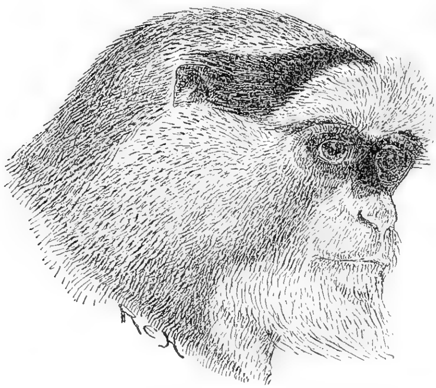
The NEGLECTUS-group.

Cercopitheci barbati Sclater (in part.); *Pogonocebus* Trouess. (in part.).

Prevailing colour of head, cheeks, neck, dorsal surface, and sides of body yellowish grey, speckled with black. Upper part of face blackish, lower part (including tip of nose, upper and lower lips, and chin) clothed with white hair, the skin blue. A mesially interrupted black brow-band. Behind this a large fiery-red diadem broad in the middle and tapering laterally. Behind this a sharply defined jet-black transverse band, narrowest in the middle and expanding at the sides, where it extends backwards to the ears. On the throat a patch of white hairs ending in a point behind on the fore part of the chest and continuous with the white of the chin in front. The hair of this area mesially long, forming a white beard, which is not restricted to the point of the chin. Hairs of the chest short, directed backwards and downwards. Fore leg black externally, at least below the elbow, its radial aspect and area above elbow olive-green, speckled; a black stripe set off by a paler one running obliquely down the upper portion from the shoulder to the radial side of the elbow and continuous with the radial edge of the black of the lower arm. Tail with its basal two inches the same colour as the back; the rest jet-black. Area of rump below the callosities white and continuous with the white of the inner side of thighs and of the pubic area. On the outer side of the thigh a crescentically curved pale stripe runs from the white beneath the callosities and descends to the knee. Apart from this pale stripe the outer side of the thigh and lower leg is greyish or olive, darker above and over the knee, where the pigmented area is strongly contrasted with the white of the inner side of the thigh; foot and ankle black. Ventral surface from the chest to the pubic area sooty olive-grey.

Distr. Region of Lake Rudolf to the Cameroons and Congo.

Text-fig. 180.



Head of *Cercopithecus neglectus* Schlegel.

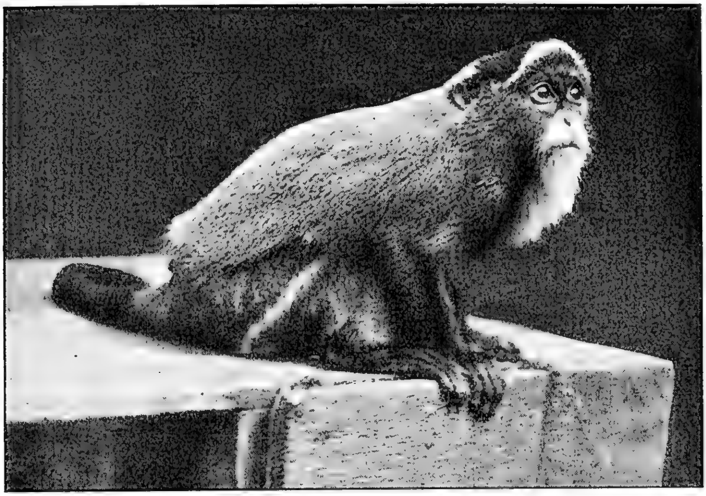
(From P. L. Sclater, P. Z. S. 1893, p. 255.)

C. neglectus has hitherto been associated with *C. diana* on account of the presence of a white beard and of a white stripe on the external aspect of the thigh arising from a point near the ischial callosity. The importance of these characters as evidence of affinity is, however, lessened by the fact that *C. mona* has a white patch close to the callosity; that in *C. neglectus* the white stripe in question starts at a point on a level with the lower margin of the callosity, whereas in *C. diana* it arises at its upper margin; that in *C. neglectus* the beard is not an isolated tuft depending from the point of the chin, as in *C. diana* and *C. roloway*, but is formed by the elongation of the hairs covering the inferior edge of the lower jaw and of the throat; and that in *C. diana* the beard is scarcely developed. These differences, taken in conjunction with the dissimilarities in colour, in the direction of the growth of the hairs on the cheek, destroy confidence in the conclusion that they are to be regarded as criteria of kinship close enough to warrant the association of the two species in one section of the genus *Cercopithecus.*

It appears to me that the characters of the one known species point to its being an aberrant type of the Leucampyx-group. From these it differs principally in the red colour of the brow-band;

the presence of the black stripe behind it on the head; the backward extension of the throat-patch to form a point on the chest; the length of the hairs on the chin; the presence of the white stripe on the thigh; and the sharp line of demarcation between the speckled base of the tail and the black distal portion.

Text-fig. 181.



Cercopithecus neglectus Schlegel.

(From a young specimen from the Cameroons, now living in the Society's Gardens.)

To this section belongs the single species presenting the characters of the section. Its synonymy is as follows:—

CERCOPITHECUS NEGLECTUS Schlegel. (Text-figs. 180, 181.)

Cercopithecus leucocampyx (errore for *leucampyx* Fisch.) Gray, Cat. Monkeys Brit. Mus. p. 22, 1870 (nec *leucampyx* Fischer).

Cercopithecus neglectus Schlegel, Mus. Pays-Bas, vii. p. 70, 1876; and of recent authors.

Cercopithecus brazzæ M.-Edwards, Rev. Sci. (3) xii. 1886; P. L. Sclater, P. Z. S. 1893, p. 255, and p. 443, pl. xxxiii.*

Loc. Region of the White Nile and Lake Rudolf to the Congo and Cameroons.

The examples of this species that I have seen appear to be

* In this figure the limbs are much too long, the beard is yellow instead of white, and the stripe on the thigh is omitted.

referable to two distinct kinds, which are regarded as subspecies and may be distinguished as follows:—

a. Outer side of hind legs down to ankle pale greyish green, speckled, only a little darker than the area above the thigh-stripe and sharply defined from the black of the foot and ankle; a little darker over knee .... Subsp. *brazziformis.*

a'. Outer side of legs blackish olive, much darker than area above thigh-stripe and not so strongly contrasted with the black of the ankle and foot; a considerable quantity of black over the knee .... Subsp. *neglectus.*

The type of *C. neglectus brazziformis* is the skin of the Monkey identified by Dr. Sclater as *Cercopithecus brazzæ* (P. Z. S. 1896, p. 780), which was said to have come from the French Congo. I can find no evidence for this locality. The animal was purchased by the Society from the Gardens in Antwerp, and may therefore have come from Belgian rather than from French territory in W. Africa.

Of what may be regarded as the typical form, the British Museum possesses the imperfect skin obtained by Petherick on the White Nile and referred by Gray with some insight to *C. leucampyx*; a specimen shot by Donaldson Smith on the Omo River, north of Lake Rudolf; a third from the Charada forest in Kaffa, 6000 ft., procured by Mr. W. N. Macmillan. From these I cannot distinguish subspecifically a series sent home by Mr. G. L. Bates from the Ja River, Cameroons, and taken near the bank of the river at an altitude of 2000 ft.

The measurements Mr. Bates gives of his specimens are as follows:—

♂.	Head and body	580 mm.,	tail	680	mm.
♀.	,, ,,	470 ,,	,,	490	,,
♀.	,, ,,	485 ,,	,,	510	,,
♀.	,, ,,	500 ,,	,,	470	,,

One of Mr. Bates's specimens differs markedly from the others and from the eastern forms. The dirty white colour of the chest extends past the mammæ and spreads on to the inner side of the arm, even below the elbow; most of the hairs on the black band on the head, especially in the middle, have a reddish subapical band; the tail is not jet-black, but tinged with rufous, the pale basal area and the dark portion being much less sharply demarcated.

According to Mr. Bates the native name for this Monkey in the Cameroons is "Avut" or "Fum."

THE LEUCAMPYX-GROUP.

Diademia Reich.

Skin of face slate-blue; upper and lower lips and often the nose clothed with short greyish-white hairs. No pink area on upper and lower lips. Fringe of hair on ears almost always white. No black stripe on brow, temple, or cheek; but frequently a speckled or whitish brow-band when the summit of the head is black. Cheek-hairs usually speckled grey and black, rarely black, and contrasted with the darker often jet-black colour of the top of the head and nape. Forearm jet-black outside, dark inside, the two surfaces gradually blending in tint; the black of the upper arm frequently continued from shoulder to shoulder. Upper surface and sides of body almost always uniformly speckled greyish yellow and black, the pale annuli in the hairs rarely with a rufous tinge. Tail the same colour above as below, speckled proximally, darker, usually quite black distally. Hind legs black externally or weakly speckled; dark grey internally. Chin and throat grey or white, paler than the chest and belly, which are black or dark grey and almost always darker than the sides of the body. Rarely the whole ventral area red.

Distr. Basin of the Congo; S. Abyssinia; Lake Mweru.

The species of this section differ from those of the Albogularis-section in the absence of the red or yellow tint from the fur of the dorsal area, the predominance of the black pigment in the hairs of the head, shoulders, hind legs, and belly. In *C. stuhlmanni* the belly is scarcely darker than in some of the forms of the Albogularis-section, and the hairs of the hind legs, though nearly black, are annulated. The head and shoulders, however, are jet-black. In *C. opisthostictus*, on the contrary, the head and nape much resemble those of *C. moloneyi*, but the belly and hind legs are black.

This group is also unmistakably nearly allied to the Nictitans-group, through such a form as *C. leucampyx boutourlinii*; and also, I believe, though less closely, to the Neglectus-group.

The material of this group that I have seen is insufficient to establish with certainty the rank that should be assigned to the various forms below recognised. Provisionally I refer them to three species, namely *C. leucampyx*, *C. opisthostictus*, and *C. kandti*; and divide *C. leucampyx* into a considerable number of subspecies. Some of the latter may, however, prove to be worthy of specific status, or to be merely based upon individual variations dependent perhaps on age; while, on the contrary, forms intermediate between *C. opisthostictus* and *C. leucampyx* or between *C. kandti* and *C. leucampyx* may prove that *C. opisthostictus* and *C. kandti* are but subspecies of the earliest described species of the group.

The characters of the three above-mentioned forms, regarded as species, may be tabulated as follows:—

a. Lower surface, inside of hind legs, and of fore legs at base red; some red close to and upon the base of the tail .... *kandti*.

a'. Above-mentioned areas not red.

- *b*. Summit of head and nape of neck thickly speckled with grey and much less markedly darker than the sides of the neck and cheeks; black and pale annuli in the hairs on the body subequal in width .... *opisthostictus*.
- *b'*. Summit of head and nape not thickly speckled with grey and therefore much darker than the sides of the neck and cheeks, when the latter are speckled; pale annuli on hairs of body much narrower than the black .... *leucampyx*.

Cercopithecus leucampyx Fischer.

Key to the subspecies here recognised :—

a. Hairs clothing sides of neck and of cheeks, except close to the face, jet-black, like the top of the head and the shoulders; a sharply defined, mostly white brow-band .... Subsp. *nigrigenis*.
a'. Hairs clothing sides of neck and of cheeks speckled black and yellowish grey.
  b. A brow-band of speckled or whitish hairs sharply defined from the black of the summit of the head; colour of thighs and of sacral area usually gradually blending.
    c. Median area of back greenish, turning to a ruddy tinge on the root of the tail; sides of body noticeably paler and greyer than back; tail not distally black .... Subsp. *doggetti*.
    c'. Back, sides of body, and root of tail nearly uniformly grey, speckled; tail black distally.
      d. Area between shoulders covered with nearly jet-black hairs forming with the hairs of the fore legs, nape, and head a continuous black area; hairs on belly distinctly annulated; some grey or white in brow-band.
        e. Thighs much darker than sacral area and sharply defined therefrom (*teste* Cuvier) .... Subsp. *leucampyx*.
        e'. Thighs not sharply defined in colour from the sacral area .... Subsp. *stuhlmanni*.
      d'. Area between shoulders grizzled like the rest of the back, but a little darker; belly-hairs duskier, less annulated; brow-band speckled like cheeks .... Subsp. *carruthersi*.
  b'. Brow-band much less defined, the summit of the head and the nape of the neck decidedly speckled, though blackish; thighs black and sharply defined from sacral area.
    f. A conspicuous black patch on temple in front of ear; brow-band largely white.. Subsp. *pluto*.
    f'. No conspicuous black patch on temple in front of ear; no white in brow-band .... Subsp. *boutourlinii*.

Subsp. leucampyx Fisch.

Cercopithecus diana (Le Diane, femelle), F. Cuvier, Hist. Nat. Mamm. i. pl. xvi., 1824.

Cercopithecus leucampyx Fischer, Syn. Mamm. p. 20, 1829 (type *C. diana* ♀ of F. Cuvier).

Cercopithecus diadematus Is. Geoffr. St. H. in Bélang. Voy., Zool. p. 51, 1834 (type *C. diana* ♀, F. Cuv.).

Head, neck, shoulders, arms, legs, and tail black, belly and chest not so dark as the rest. Thighs sharply marked off by colour from the sacral region of body, which, like the entire region behind the shoulders, is grey, ticked black and white. Brow-band conspicuous, white with a tinge of yellow. The whole of the cheek below a line joining the eye and the inferior edge of the ear covered with grey, speckled hairs; the sides of the neck similarly coloured. Lips, chin, and nose covered with short white hairs.

Loc. W. Africa.

I have seen no specimen quite agreeing with Cuvier's description and figure of this species. In drawing up the above-given diagnosis and in placing the subspecies in the analytical key, I have been dependent upon the characters furnished by that author.

Subsp. STUHLMANNI Matschie. (Plate XXXIX. fig. 2.)

Cercopithecus stuhlmanni Matschie, SB. Ges. nat. Fr. Berlin, 1893, p. 225.

Cercopithecus otoleucus P. L. Sclater, P. Z. S. 1902, vol. i. p. 237, pl. xxv.

Said to resemble *C. leucampyx* in the blackness of the head, the neck, and the anterior limbs, the greyish tint of the upper side, the white frontal band, white lips and chin, and the grey annulated hairs on the whiskers; and to differ from that species in having the greater part of the tail, the inner side of the legs, and the belly coloured like the back, and the outer side of the hind limbs also coloured like the back but darker, and the throat as well as the chin snow-white, and with some longer yellowish-white hairs on the border of the ear.

Length of body 660 mm., of tail 945 mm.

Loc. E. Africa: north of Kinjawanga, a little to the west of Ituri, between Lakes Albert Edward and Albert, 29° 35′ E. lat., 0° 25′ N. long.; also Kwidjvi Island in Lake Kivu.

In the type of *Cercopithecus otoleucus* now living in the Gardens, the head, nape, area between the shoulders, shoulders, and fore legs are jet-black. The brow-band is grey-white, not snow-white, the hairs of its anterior portion being greyish and speckled like those of the cheek. The hairs of the ears are not white, but faintly tinged with pinkish red. The skin of the face is deep slate, with short whitish hairs on the lips. The throat and chin are white, and there is a dusky patch crossing the fore part of the chest behind the white of the throat. The whole body above is speckled grey and black. The belly also is speckled like the back, but not so thickly, and the thighs externally are speckled and not sharply marked off in colour from the sacral area, the tints of the two gradually blending. The tail is black at its distal end, speckled with grey proximally.

The specimen came from Latuka Mountain in North Uganda (*Delmé Radcliffe*).

Dr. Matschie appears to think that the type of *C. otoleucus* may be distinguished from that of *C. stuhlmanni* by having no white on the chin, and the hind legs and tail black. This is not the case, as the above-given diagnosis shows, and it is highly probable that the two are subspecifically identical.

Dr. Matschie has recently described, under the name *C. neumanni*, some specimens from Kwa Kitoto in North Kavirondo (SB. Ges. nat. Fr. Berlin, 1905, p. 266, pl. x.). This so-called species is said to differ from *C. stuhlmanni* in that the hairs of the brow-band are not grey-white but narrowly banded with dusky grey, and the hairs on the ears grey and not white; the hind legs also are darker and only slightly speckled, and the belly mouse-grey and speckled instead of olive-grey and speckled.

In the British Museum (Reg. no. 1.8.9.17) there is a skin of a specimen procured by Sir H. H. Johnston at an altitude of 4000 feet in the Mpanga Forest, which appears to differ from the type of *C. otoleucus* only in the absence of greyish-white hairs in the brow-band. In the continuity and completeness of the jet-black hue of the head, nape, and shoulders it resembles the types of *C. l. otoleucus* and *nigrigenis*, and, I presume, also of *C. l. stuhlmanni* and of typical *C. leucampyx*. It leads from the foregoing, which have at least some white in the brow-band, to the two following subspecies, in which no white is therein traceable. Additional specimens may prove this example to be worthy of recognition as a distinct subspecies. The head and body of the Mpanga Forest specimen measure 574 mm. (=23 inches) and the tail 900 mm. (=36 inches).

It should be stated that, in the diagnosis of *C. stuhlmanni*, Matschie does not mention the presence of a black bar across the chest, which is present in the example from the Mpanga Forest and also in other specimens of this group of *Cercopithecus*, where the belly and chest are of a greyish hue.

Subsp. CARRUTHERSI, nov.

Closely related to *C. l. stuhlmanni*, but distinguishable by the absence of white in the brow-band and the less amount of blackness of the area between the shoulders, which is ticked with grey, being only a little darker than the back and decidedly lighter than the head. The belly also is less speckled with grey, and hence darker.

Loc. Ruwenzori, east side, 10,000 ft. (*D. Carruthers*). Type in Brit. Mus.

There is also a native-prepared skin, apparently of the same subspecies, in the British Museum, ticketed "Uganda (*G. F. Scott Elliot*)." Possibly it also came from Ruwenzori.

Subsp. DOGGETTI, nov.

Summit of head, including area round ears, and nape of neck to area between shoulders, where speckling commences, jet-black. Whiskers and brow-band olive-grey ticked with black. Median area of back greenish grey, speckled; sacral region with reddish-brown tinge, but speckled. Sides of body speckled, but greyer than dorsal area. Tail nearly black at the distal end, the rest greyish above and below, speckled only at the base. Fore leg and hands jet-black externally; hind leg from hip blackish grey, speckled; foot quite black. Belly and inside of limbs ashy grey; a dark band crossing the region of the collar-bones. Middle line of throat white, the white narrower than in the type of *C. omensis*. Head and body 487 mm., tail 655 mm. (? imperfect).

Loc. S.W. Ankole, between Lakes Victoria and Albert Edward (*W. Doggett*).

A single female specimen in the collection of the British Museum.

This subspecies is characterised by the rufous speckling at the base of the tail, the extension of the speckling, although indistinct, to the tip of that organ, the yellower hue of the back as compared with the sides, and the greyness of the sides of the body and of the belly.

Subsp. NIGRIGENIS, nov. (Plate XXXIX. fig. 1.)

Cercopithecus leucampyx P. L. Sclater, P. Z. S. 1893, p. 253 (nec *C. leucampyx* Fischer).

Brow-band broad in the middle, narrowed laterally, mostly white, its anterior hairs long, annulated, pigmented almost to the base and continuous laterally with the similarly pigmented and annulated hairs of the anterior part of the cheek adjacent to the naked or nearly naked skin of the face. The whole of the summit and back of the head, the nape and sides of the neck, and the shoulders both above and laterally, as well as the area in front of and below the ears and on the greater part of the cheek, jet-black, the black hair on the cheek gradually blending in front with the speckled hair on the anterior part of the cheek adjacent to the face and inferiorly with the greyish-white hair clothing the inter-ramal area and the throat. Upper and lateral portions of body behind shoulders speckled greyish yellow, a little yellower dorsally than laterally; the speckling scarcely extending on to the tail, which, for the greater part of its length above and below, is black. The posterior part of the throat, the chest, and belly black. Limbs, outside and inside, and hands and feet black; back of the thighs and, in the female, the pubic region greyish and obscurely speckled.

Loc. W. Africa.

The type and only known representative of this subspecies is a single female specimen, ticketed "W. Africa," in the Society's collection. This was identified as *C. leucampyx* by Dr. Sclater, who followed Schlegel in thinking *C. pluto* of Gray a synonym of *C. leucampyx*. This specimen differs, however, from the type of *C. leucampyx*, as it does from all the other representatives of this group, in having the sides of the neck and almost the entire cheek jet-black. It further differs from the type of *C. pluto* in having the brow-band sharply defined.

Subsp. PLUTO Gray.

Cercopithecus pluto Gray, P. Z. S. 1848, p. 56 (text-fig., p. 57), pl. iii.

Brow-band not sharply defined behind from the colour of the rest of the head, consisting for the most part of white hairs apically annulated. Summit and back of head black, speckled with grey. A black patch on the temple in front of the ear, but the rest of the hairs on the cheek, both close to the face, beneath the ear, and on the sides of the neck, speckled grey and black. Nape of neck and shoulders black, but speckled with grey. Dorsal surface and sides of body paler than shoulders, speckled grey and black. Tail speckled in its basal portion, the greater part of it black. Fore limb jet-black. Hind limb black, slightly speckled but sharply defined by its colour from the sacral area. Belly and chest sooty grey, not speckled.

Loc. Angola.

The type of this species is in the British Museum: No. 50.7.9.2. It formerly lived in the Society's Gardens. There is also in the

British Museum a younger specimen of the same subspecies, not differing in any very striking characters from the type.

By common consent *C. pluto* Gray has of late years been regarded as strictly synonymous with *C. leucampyx* Fischer. The type of *C. pluto*, however, at least differs from that of *C. leucampyx* in having the summit of the head, the nape of the neck, and the shoulders distinctly speckled with grey. Hence the brow-band lacks the definition seen in typical *C. leucampyx* and in *C. leucampyx nigrigenis*, and approaches the condition observable in *C. l. boutourlinii*.

Subsp. BOUTOURLINII Gigl. (Text-fig. 182.)

Cercopithecus boutourlinii Giglioli, Zool. Anz. x. p. 510, 1887; P. L. Sclater, P. Z. S. 1893, p. 441; Forbes, Monkeys, i. p. 69, 1894.

Text-fig. 182.

Cercopithecus leucampyx boutourlinii Giglioli.
(From P. L. Sclater, P. Z. S. 1893, p. 442.)

Cercopithecus albigularis Gigl. Ann. Mus. Genov. (2) vi. p. 8, 1888 (nec Sykes).

Cercopithecus omensis Thos. P. Z. S. 1900, p. 801.

Brow-band not sharply differentiated from summit of head, which, like the nape, although blackish, is speckled with yellowish grey. Anterior hairs of brow-band darker than in *C. l. stuhlmanni*; no black patch of hair in front of the ear. Shoulders black but speckled with grey, at least in the middle line. Dorsal and lateral areas of body speckled greyish yellow, uniformly tinted; tail speckled only at the base, the rest black. Fore legs jet-black; hind legs also jet-black, and sharply defined from the sacral region. Belly jet-black, not speckled. Throat, lips, and chin white, a smudge of black defining the white of the lips. Head and body 600 mm., tail 700 mm.

Loc. Southern Abyssinia to Lake Rudolf.

The above-given description is taken from an adult specimen in the British Museum obtained in the Charada Forest, Kaffa (600 ft. alt.), by Mr. W. N. Macmillan. Giglioli's type also came from Kaffa. Sclater records another specimen in the Florence Museum from Abugifar in Grimma, province of Gojam. The type of *C. omensis*, a young animal, was from the Omo River, which flows southwards into the northern extremity of Lake Rudolf.

This form, species or subspecies, is obviously more nearly related to *C. leucampyx* than to *C. albogularis*, with which Giglioli, Sclater, and Forbes compared it. This mistake as to its affinities may have misled Thomas into describing the type of *C. omensis* as a new species.

Cercopithecus opisthostictus Sclater.

Cercopithecus opisthostictus P. L. Sclater, P. Z. S. 1893, p. 725.

Skin of face dark, upper lip scantily clothed with white hairs; lower lip, chin, and throat white. Upper surface of the head and nape greyish black, the black predominating, the two pale annuli on the hairs much narrower than the intervening black spaces; on the anterior part of the forehead, however, the grey predominates, as also on the cheeks and sides of the neck, which are decidedly paler than the crown and nape. Area between shoulders blackish, the grey annuli being very narrow. Shoulders and arms black. Thoracic, lumbar, and sacral regions of body and root of tail speckled, the hairs with four or five grey annuli, which for the most part exceed the black spaces in width. Ventral surface jet-black from the anterior extremity of the chest to the pubic region. Legs black externally from the hip to the foot, grey, but not so grey as the back, internally. Tail greyish in its basal third, becoming gradually blacker, almost its distal two-thirds jet-black. Sometimes, but not always, there is a reddish-brown patch on each side near the root of the tail.

Length from crown of head to root of tail 525 mm., of tail 700 mm.

Loc. Region of Lake Mweru.

I have seen four specimens of this species. The two flat imperfect skins sent to Dr. Sclater by Vice-Consul (now Sir Alfred) Sharpe from Lake Mweru; a third, sent by the same collector, to the British Museum (No. 92.2.6.2), and ticketed "Nyasaland." The fourth and best of the series is also in the British Museum (No. 95.7.12.1); it was sent to that institution by Mr. F. S. Arnot, who procured it in the Kundilungo Mountains, west of Lake Mweru.

The black belly, limbs, and shoulders, the predominance of black on the head, the white chin and throat, and the absence of red from the dorsal area, enforce the inclusion of this species in the Leucampyx-group of the genus.

CERCOPITHECUS KANDTI Matschie.

Cercopithecus kandti Matschie, SB. Ges. nat. Fr. Berlin, 1905, p. 264.

Summit of head and nape jet-black; summit of shoulders blackish but speckled. Brow-band and whiskers on cheeks greyish green, speckled. Back from behind shoulders to sacral region speckled greyish green, with reddish-yellow bases to the hairs. A quantity of rusty-red hair on the buttocks both above, below, and at the sides of the tail. Tail rusty red at the base, the red gradually fading posteriorly, the distal portion black and more or less speckled. Fore legs jet-black; hind legs blackish but speckled. Ventral surface, inside of fore legs at the base and of the hind legs rusty red.

Loc. Near Lake Kivu (*Powell Cotton*); north of Lake Kivu (*Matschie*).

The above-given description is taken from two flat native-prepared skins in the British Museum presented by Major Powell Cotton.

This species differs from other members of the Leucampyx-group by the rufous tint of the underside and of the area round the base of the tail. It might almost be described as an erythristic form of *C. leucampyx stuhlmanni*.

THE NICTITANS-GROUP.

Rhinostictus Trouess. (in part.).

Closely resembling the Leucampyx-group in general coloration, but with the hairs on the nose forming a well-defined large white or yellowish spot, sharply differentiated from the darker-coloured upper and lower lips, and with strongly convex upper border. Distinguished from the Petaurista-group by the absence of the black brow-band and of a black stripe crossing the temple from the eye to the ear. No black stripe on the cheeks, which are uniformly speckled greenish black. Head and nape darker than the back, which is blackish speckled with grey, but scarcely yellowish. Tail the same colour above as below, black throughout the greater part of its length. Fore legs black. Belly greyish black and grizzled; throat and sometimes the chest whitish.

Owing to the presence of the nose-spot, the species of this section have been hitherto associated with *C. petaurista* and its allies. It is possible that the two groups are connected through such a form as *C. signatus*, which differs from typical members of the Petaurista-group in the coloration of the cheeks; but *C. nictitans* appears to me to be much more nearly related to the Leucampyx-group, especially to *C. l. boutourlinii*, from which it differs essentially only in the greater definition of the hairs forming the patch upon the nose and their distinctness from those of the upper lip.

As bearing on the views here expressed as to the affinity between *C. nictitans* and *C. leucampyx*, it is significant that Cuvier called attention to the similarity between his Diane femelle, the type of *C. leucampyx*, and the Hocheur (*C. nictitans*).

Distr. Liberia through Nigeria to the Congo and Gaboon.

The two species referred to this group may be briefly distinguished as follows:—

a. Breast, belly, and base of fore legs on the inner side blackish; no red on ischio-pubic area .... *nictitans.*

a'. Breast and inner side of arms at base whitish; some red hairs on ischio-pubic region and on base of tail, at least in adult .... *martini.*

The differences between these two species are not very marked. I have not, however, seen any intermediates to justify me in regarding them merely as subspecific forms. Of the two, *C. nictitans* is much more commonly imported, and may usually be seen in menageries.

Cercopithecus nictitans Linn. (Text-fig. 183.)

Subsp. nictitans (Linn.).

Simia nictitans Linn. Syst. Nat. i. p. 40, 1766.

Cercopithecus nictitans Erxl. Syst. Regn. Anim. p. 35, 1777, and of subsequent authors.

Entire dorsal area from forehead to root of tail thickly speckled with yellowish grey; hairs blacker in front of and behind ears and sometimes slightly so on nape. Arms and shoulders black; legs blackish but speckled. Tail mostly black, speckled at base, without red hairs beneath. Hairs on throat and chin greyish, a black band across collar-bones; chest and belly dark grey to blackish, but more or less speckled. No red on ischio-pubic area. Hairs on body with narrow grey annuli.

Loc. From the Cameroons to Cette Cama.

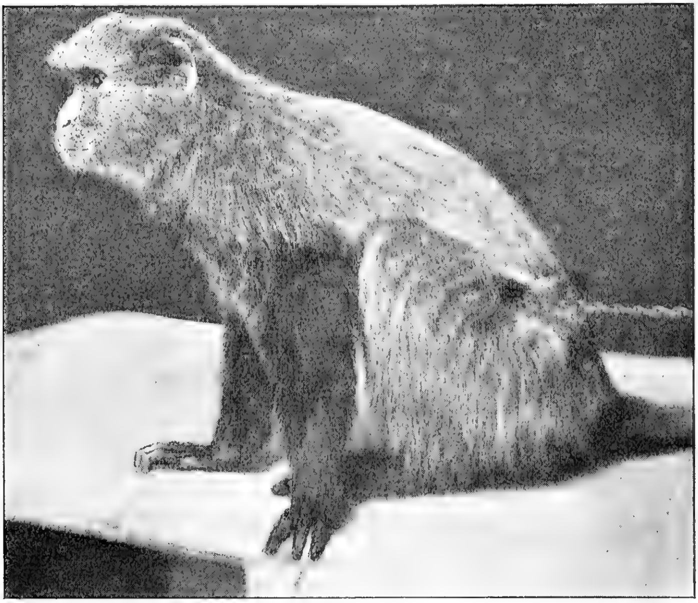
Pousargues records this species from various localities in the French Congo—namely, San Benito, Alima River, Magumba, Banqui, and Cette Cama.

Since the exact locality of *C. nictitans* is unknown, I propose to regard as typical of this species a form represented in the British Museum by examples from the Benito River, in the Congo, collected by Mr. G. L. Bates. They were taken at sea-level from fifteen to twenty miles from the mouth of the river. These specimens gave the following measurements in the flesh:—

1. ♂.	Head and body	515 mm.,	tail 805 mm.
2. ♀.	,, ,,	530 ,,	,, 775 ,,
3. ♀.	,, ,,	535 ,,	,, 860 ,,
4. ♀.	,, ,,	535 ,,	,, 860 ,,

According to Mr. Bates, the Fang name for this Monkey, known to dealers as the "Hocheur," is "Avem."

Text-fig. 183.



Cercopithecus nictitans Linn.

(From a specimen living in the Society's Gardens.)

Mr. Bates also obtained examples from Efulen in the Bulu Country, Cameroons, 1500 ft. alt. These differ from the Benito River examples in having the hairs on the fore part of the throat and on the posterior part of the abdomen washed with brown. I do not know whether this difference in tint has any systematic value, or whether it is due to artificial staining of the hair during the preparation of the skins. The measurements of two are as follows:—

1. ♀.	Head and body	530 mm.,	tail 800 mm.
2. ♀.	,, ,,	540 ,,	,, 750 ,,

Subsp. LAGLAIZEI, nov.

Like the Benito River form, which I regard as typical, but much greyer dorsally, owing to the greater length of the grey as compared with the black annuli on the hairs. In a back hair of *C. nictitans laglaizei*, picked haphazard, measuring 80 mm., the ultimate pale annulus measures 4 mm., the penultimate 5 mm., and the intervening area about 8 mm.; whereas in a hair of *C. nictitans nictitans*, measuring 65 mm., the ultimate pale annulus is 1·5 mm., the penultimate 2 mm., and the intervening area about 8 mm. These differences are fairly constant. In no case do the pale annuli of the typical form nearly reach half the width of the intervening dark annulus.

Loc. Gaboon (*Laglaize coll.*). In B.M., Reg. no. 80.6.7.1.

CERCOPITHECUS MARTINI Waterh. (Plate XXXIX. fig. 5.)

Cercopithecus martini Waterhouse, P. Z. S. 1838, p. 58; 1841, p. 71.

Cercopithecus ludio Gray, P. Z. S. 1849, p. 8, pl. ix. fig. 2.

Cercopithecus stampflii Jentink, Notes Leyden Museum, x. p. 10, 1888.

? *Cercopithecus temmincki* Ogilby, Is. Geoffr. St. H. Dict. Hist. Nat. iii. p. 303, 1845.

Skin of face (dried) black; lips clothed with short whitish hairs; nose-spot large, white; hairs on cheek and sides of neck speckled black and yellowish. Head speckled black and yellow on forehead, the yellow speckling more pronounced than on cheeks; on the crown of the head, the nape of the neck, in front and behind the ears the yellow speckling much less conspicuous, the black largely predominating owing to the disappearance of the distal yellow annuli. Back from behind the shoulder to the root of the tail densely speckled with yellowish grey, which predominates over the black. Arms black externally. Legs darker than back but speckled; hands and feet black. Throat and chest dirty greyish white; the pale area of the throat separated from that of the chest by a faint blackish band; the pale area of the chest extending in a point backwards to the end of the sternum, and spreading on to the base of the arms on the inner side. Belly dark smoky grey, faintly speckled, the colour becoming paler posteriorly and upon the inner side of the thighs. A considerable quantity of rusty-red hair upon the ischio-pubic region. Tail with its basal fourth like the sacral area; some reddish hairs by the anus beneath; the distal three-fourths black.

Loc. Liberia to the Cameroons.

Cercopithecus martini was based upon a native-prepared and imperfect skin, with the face and other parts cut away. It is in the British Museum, and is labelled "Fernando Po." It does not appear to be specifically or subspecifically separable from the form named *C. ludio* by Gray. *Cercopithecus stampflii* was described as distinguishable from *C. nictitans* by having white-coloured underparts, but in the description only the chin, breast, fore part of the belly, and the upper part of the inside of the fore limbs are said to be white. Examination of a large number of skins may show that Liberian and Nigerian examples are subspecifically distinct; but as yet there is no evidence of this, so far as I am aware.

The above-given description is taken from the skin of an adult female in the British Museum labelled "Neighbourhood of Cameroon Mountains, 71.7.8.2; purchased of Mr. Cutler." There is also a smaller example in the British Museum from Jebba, on the Niger (*G. F. Abadie*: no. 0.3.29.1), which has the belly paler and the tail more speckled and no red on its base beneath and no red hairs on ischio-pubic region; also three specimens (♀) in the Society's collection labelled "W. Africa," and numbered 11.7.96 to 21.4.1901, 6.3.1900 to 24.1.1901, 3.4.1900 to 15.8.1900, the numbers indicating the date of arrival and death. These have more green in the hair than the wild-killed examples, and the white of the chest extends down the middle line of the belly about as far as the umbilical region, and in neither is there so much red upon the anal area as in the adults.

Recently the Society received as a donation from Captain Rudkin a very young example from Asaba, on the Niger.

There is also in the British Museum a specimen labelled "Delta of the Niger; Dr. Baikie's Coll.; no. 62.7.17.3," which differs from the other examples I have seen in having the nose-spot pale lemon-yellow instead of white and the pale areas of the frontal hairs much redder, the red being particularly noticeable in those just above the eyebrows. The speckling of the belly and back is also less distinct.

Additional examples from this same area may prove these characters to have subspecific value.

THE ALBOGULARIS-GROUP.

Nearly allied to the Leucampyx-group, but with much less black pigment in the coat. The head, nape, shoulders, and cheeks very uniformly coloured, as a rule speckled yellowish-grey and black; the head sometimes a little darker, rarely with a red tinge or patches of red. The lumbar and sacral regions of the back more brightly coloured than the shoulders and head, owing to the presence of yellow or red annuli in the hairs, the red or yellow sometimes restricted to the dorsal area, sometimes spread over the sides of the body.

a. Proximal third of under side of tail nearly white and sharply defined from the iron-grey upper side; dorsal area of body dark iron-grey with scarcely a tinge of yellow .... *labiatus.*

a′. Upper and under sides of tail uniformly coloured, or approximately so; some yellow or red in the hair, at least of the lumbo-sacral area of the body.

  b. Some almost wholly red hairs on the head, forming at least a rufous patch above and in front of the ears.

    c. Cheeks strongly suffused with rusty red and markedly contrasted with the blackish-grey tint of the shoulder adjacent to the neck .... *rufotinctus.*

    c′. Cheeks without any red, approximately of the same speckled yellowish-grey tint as the shoulders .... *stairsi.*

b'. No red on the head.
d. A conspicuous white collar extending over the sides of the neck on to its dorsal area, its two extremities only separated by a narrow area of iron-grey speckled hair ... *kolbi.*
d'. Collar less conspicuous; when present, not reaching the dorsal area of the neck.
e. Dorsal area of lumbo-sacral region speckled chestnut-red, and sharply contrasted with the speckled stone-grey tint of the sides; summit of head noticeably darker than the shoulders and cheek .... *moloneyi.*
e'. Coloured hairs on the body either extending all over the sides, or when restricted to the dorsal surface set off laterally and on the shoulder by very dark speckled hairs; head not darker than shoulders or cheeks.
f. Hairs on ear mostly black; black hairs on nose and upper lip; coloured area of back speckled dark rusty brown; prevailing colour smoky grey .... *preussi.*
f'. Hairs on ear whitish or red; coloured area of back yellower; no black hairs on nose or lip.
g. Hairs on ear decidedly red; coloured area of body restricted to dorsal region .... *francescæ.*
g'. Hairs on ear whitish; coloured area extending all over sides .... *albogularis.*

Cercopithecus albogularis Sykes.

Semnopithecus? albogularis Sykes, P. Z. S. 1831, p. 106.
Cercopithecus albigularis Sykes, P. Z. S. 1832, p. 18.
Cercopithecus erythrarchus Peters, Reise Mossamb., Säugeth. p. 1, pl. i., 1852.

♂ ♀ *adult.*—Head, cheeks, and dorsal area between shoulders speckled black and grey, the head only a little darker than the cheeks. Behind the shoulders the grey in the hairs is gradually replaced by yellow, the entire lumbar and sacral regions being uniformly washed with that colour, which spreads also on to the sides of the body and the root of the tail. Arms not wholly black, speckled close to shoulder and along the radial side of forearm. Legs dark ashy grey, thickly speckled; hands and feet quite black. Chin, throat, inner side of upper arms and of legs dirty greyish white. The rest of the ventral surface, which is of a darker grey, practically unspeckled in the female. In the male the under side is densely speckled, the inner side of the thighs and pubic area and the throat remaining unspeckled. Tail mostly black, speckled with yellow at base, then for a short distance with grey, the rest black. Root of tail and ischio-pubic region in male without red hairs. In the female the root of the tail and the sides of the callosities rusty red. The young of both sexes resembles the female in this respect, and also in having the whole of the under side greyish white and unspeckled, but differs from the adults of both sexes in having some almost wholly red hairs upon and close to the root of the tail above and the backs of the thighs faintly tinged with red. In these respects they recall *C. stairsi*.

Loc. Southern Nyasaland: Zomba (*A. Sharpe*); Blantyre (*B. L.*

Sclater); Chiradzula (*A. Whyte*); Milanji Plateau, 3500 ft., and Fort Lister, Milanji, 6000 ft.; Manzi, on the E. shore of Lake Shirwa (*A. Sharpe*).

The skins from the above-mentioned localities are in the British Museum and in the Society's Collection.

This form has also been recorded from Cape Corrientes (*Peters*) and from Quilimane and the Lower Zambesi (*Peters & Kirk*).

The adult male and female from which the description has been taken came respectively from Fort Lister, Milanji, and from Chiradzula. I have also seen young females from Milanji and Chiradzula, and a young male from Manzi.

The name *albogularis* or *albigularis* has been applied to Monkeys both from East and West Africa. The type of *C. albogularis*, however, was said to have come from Madagascar. This information fixes with practical certainty some part of East Africa as its origin. In the original description, Sykes speaks of the coloured area of the back as "*yellowish ochre*"; and since the East-African specimens known to me which best fit this description are those referable to the form named *C. erythrarchus* by Peters, I regard *erythrarchus* as a synonym of *albogularis*. In this I follow Dr. Forbes, who, however, altered the wording of Sykes's description, and described the coloured area of the back as "brownish yellow": from which it may be inferred that the specimens he had before him at the time were not true *C. albogularis*, but were possibly racially identical with the examples described below from the Rufiji River.

Subsp. BEIRENSIS, nov.

Closely allied to the Nyasaland form *C. albogularis albogularis*, the back and sides being speckled with pale yellow. A slight rufous tinge in the hairs on the sacral region; but at the root of the tail above and below, as well as on the adjacent area of the rump, a quantity of bright red hair. The whole of the under side of the body and the inside of the hind legs to the ankle whitish; the back of the thighs whitish tinged with rufous.

Loc. Beira.

Two adult male examples in the British Museum belonging to the Rudd Collection, and shot by Mr. Claud Grant. Measurements in mm. of larger specimen: head and body 561 mm., tail 601; of smaller: head and body 501, tail 658.

These animals, although adult, resemble the young of the Nyasaland form in the paleness of the under side and the presence of the rufous tinge on the rump and the root of the tail. In these respects they differ from the adult of the Nyasaland form *C. a. albogularis*.

The type of this subspecies is remarkably like that of *C. stairsi mossambicus*, practically the only difference between them being the absence of red on the head of *C. a. beirensis*.

Subsp. RUFILATUS, nov.

? *Cercopithecus monoides* Is. Geoffr. St. H. Arch. Mus. ii. p. 551, pl. xxxi., 1841.

Closely resembling the Nyasaland form, but with the back and sides behind the shoulders speckled a rich reddish orange-yellow. Head and neck somewhat thickly speckled with black. No distinct whitish half-collar. Belly smoky grey, darker than in the Nyasaland subspecies. Thighs dark grey, speckled and sharply defined from the lumbo-sacral area and the flanks.

Loc. Rufiji River, S. of Zanzibar.

Two specimens in the British Museum, presented by Capt. Wharton, Nos. 78.12.26.1–2. Also a specimen ticketed "Kima, from the coast up to 9000 ft." (*Carlisle Fraser*, 97.2.14.4); and a third ticketed "Zanzibar Island (*J. T. Last*, 06.6.5.6)," which is not so richly coloured as the Rufiji and Kima examples.

Subsp. ALBOTORQUATUS Pous. (Plate XXXIX. fig. 4.)

Cercopithecus albotorquatus Pousargues, Bull. Mus. Paris, ii. p. 56, 1896; O. Neumann, P. Z. S. 1902, vol. ii. p. 144 (wrongly assigned to Thomas).

Head, nape, shoulders, and cheeks almost down to corners of mouth practically uniformly speckled with yellowish grey and black, the cheeks a little greyer than the head. Throat, sides of neck, and anterior part of chest a little beyond the mammæ snow-white and sharply contrasted with the grey of the cheek and the blackish grey of the shoulders. The white on the sides of the neck forms a more definite half-collar than in typical *C. albogularis*, but it does not extend on to the nape or summit of the neck as in *C. kolbi*. Area from behind shoulders to root of tail speckled with yellow, which spreads over the sides of the body. Tail yellow-speckled at the base above for about two inches, becoming gradually rufous laterally and inferiorly; the rest of the tail dark, indistinctly speckled, the grey speckling gradually dying away posteriorly; the end black. Inside of fore leg at base ashy grey, becoming sooty grey towards the wrist. Outer side of thighs smoky grey, speckled; inside of thighs much paler grey, whiter at base, where they join the pubic region; back of thighs greyish white tinged with pale reddish; a considerable quantity of rusty-red hair on the area at the root of the tail above and outside the callosities. Ventral surface from behind the mammæ ashy grey, unspeckled; hairs of pubic region white.

Loc. ? W. Africa.

The above-given description is taken from a single female specimen that formerly lived in the Society's Gardens. It was identified by Mr. Sclater as *C. albogularis*.

In nearly all respects it agrees with the description of *C. albotorquatus* published by Pousargues, especially with respect to the colour at the root of the tail, on the back of the thighs, and the collar on the sides of the neck. It must be noticed, however, that

Pousargues says "*genis albis*" (cheeks white); but since there is no member of the Albogularis-group which has the cheeks, in the English acceptation of that term, white, one must conclude that Pousargues was referring to the area of the jaw behind the corner of the mouth. He could not have failed to notice so striking a difference between *C. albotorquatus* and *C. albogularis*, had the area of the face below a line from the corner of the eye to the ear been white in the type that received the former name.

CERCOPITHECUS KOLBI Neum.

Subsp. KOLBI Neum.

Cercopithecus kolbi O. Neumann, P. Z. S. 1902, vol. ii. p. 144.

Closely related to *C. albogularis*, of which it may prove to be a subspecies, but distinguishable by the greater distinctness of the white collar and its extension over each side of the neck on to the nape, so that a space of about two inches or less of speckled hair in the middle line separates the two ends. The colour of the dorsal side much resembles that of *C. albogularis rufilatus.* Hairs on the ears long and whitish or greyish.

Loc. Kedong escarpment (*C. S. Betton*, type no. 0.1.3.1 in B.M.).

The British Museum also has examples from Mt. Kenia, 8000–9000 ft. (*A. H. Neumann*), Roromo (*Lord Delamere*), and the Nairobi Forest (*C. S. Mackinder*); and there is one in the Society's collection ticketed "Uganda," which belongs to the typical or to a nearly related form.

According to O. Neumann, *C. kolbi* differs from *C. albotorquatus* Pous. by its longer fur, owing probably to its being a mountain form, by the presence of the white fringe on the ears, by the absence of red on the anal region and base of tail, and of the reddish tinge on the hind legs, and finally by the less sharp definition between the dark and white areas on the neck.

Mr. Neumann does not state whether he has seen the type of *C. albotorquatus*, or whether he differentiated *C. kolbi* by the description only. The specimens of *C. kolbi* examined by Neumann show considerable variation in the distinctness of the white collar. Again, although the skin of the pubic region is cut away, there is a considerable quantity of brownish-red hair at the sides of the ischial callosities, both in the specimen collected by Mr. Betton on the Kedong escarpment and in the one from Roromo. In the examples from Nairobi, which are altogether less well-coloured, the red hair on the anal region is not so conspicuous. Perhaps more than one subspecies is here involved.

Subsp. HINDEI, nov. (Plate XXXIX. fig. 3.)

Differs from typical *C. kolbi* in the following particulars:—

Nose and upper lip clothed with a more distinct short coating of greyish hairs. Hairs on cheeks and head with a very decided reddish-yellow not greyish-yellow tinge. Ear-tufts not uniformly yellowish white, but distinctly yellowish and banded. Collar neither so white nor so sharply defined, on the chest blending gradually with the tint of that area. Coat long and thick; lumbar and sacral regions with a very decided brownish-red or rusty-red tinge, which extends also on to the root of the tail above and below, and thence round the ischial callosities. Sides of body speckled with yellow, not with grey. Ventral surface a fairly uniform ashy grey, very indistinctly speckled. Outside of legs not so dark, less speckled, the speckling with a yellowish tinge.

Loc. Tutha, in the Kenia district, 8000 ft. alt.

A single male example, collected by Dr. S. L. Hinde in Dec. 1902 (B.M., Reg. no. 3.5.25.1).

Cercopithecus moloneyi Sclater.

Cercopithecus moloneyi P. L. Sclater, P. Z. S. 1893, p. 252, pl. xvii.

Summit of head blackish, speckled with yellow, much darker than the cheeks, which are speckled with greyish yellow; a considerable amount of white in the hairs above the brow. Area between shoulders speckled with greyish yellow. Posterior portion of back and lumbo-sacral region a rich ruddy chestnut-brown, which is somewhat sharply contrasted with the speckled grey tint of the sides of the body and the thighs. Arms wholly black, except the inner side of the upper arm, which is greyish and sometimes speckled; black of upper arm extending up as a narrow stripe in front of shoulder. Legs grey, speckled. Hands and feet black. Throat and chin dirty greyish white. Ventral surface dark grey, more or less speckled. Tail mostly black, speckled towards base, with some reddish hairs above on the root. No red on underside of root of tail nor on ischial area in male; a considerable amount in the female in these places.

Loc. North Nyasaland: between Lakes Tanganyika and Nyasa (*Sir J. A. Moloney*); Nyasa-Tanganyika plateau (*J. B. Yule*). Top of Masuku plateau (*A. Whyte*).

Cercopithecus stairsi Sclater.

Cercopithecus stairsi P. L. Sclater, P. Z. S. 1893, pp. 252 & 443, also 1902, p. 580, pl. xl.; Forbes, Monkeys, ii. p. 73, 1894 (in part., ♀).

Subsp. stairsi Sclater.

♂ (*subadult*).—Face blackish, lips scantily clothed with white hairs; summit of head speckled yellowish green in front and mesially, reddish at the sides; above and in front of the ears there is a ferruginous patch extending down as far as the corner of the orbit and composed of hairs that have lost their black annuli; posteriorly the reddish tint covers the occipital area as far down as the level of the lobe of the ear. Hairs on brow-ridge longer, with three yellowish annuli. Cheeks speckled yellowish green. Sides and nape of neck much the same colour as the cheeks. Shoulders rather greyer than neck. Area between shoulders speckled yellow and black, with faint reddish tinge. Posteriorly in the middle line the reddish tinge on the hairs increases in intensity and extent, and on the sacral region the black annuli have entirely faded away. Sides of body yellower than dorsal area, with some red hairs behind root of arm. Arms blackish and speckled with grey externally, greyish white internally. Legs pale red externally, the hairs not annulated; greyish white faintly tinged with red internally; feet grey above. Throat, lower side of neck, chest, and belly greyish white, with a faint tinge of red on the belly. Hairs round callosities on back of thighs reddish. Tail red like sacral region for three or four inches of its length above and for a shorter distance below; posteriorly the red gradually dies away, and is replaced distally by greyish black and black.

The above-given description is taken from the skin of a male from the Lower Zambesi that lived in the Society's Gardens from Dec. 14th, 1900, until Dec. 3rd, 1901.

There is also a second male specimen, younger than the latter but exactly like it in colouring. Both agree very closely with the typical female example from Chindi described and figured by Dr. Sclater and now preserved in the British Museum.

Subsp. MOSSAMBICUS, nov.

Cercopithecus stairsi P. L. Sclater, P. Z. S. 1893, p. 612; Forbes, Monkeys, ii. p. 73, 1894 (in part., ♂).

Distinguishable from the typical form by the red on the head being restricted to a relatively small rufous patch above and in front of the ear, scarcely any red being traceable behind the ears or on the occipital area. The dorsal area is very faintly tinged with red and the sides are grizzled like the nape of the neck, without any of the rich orange-yellow noticeable in the typical form. Only close to the root of the tail above and laterally are the hairs quite red and devoid of annuli. Lastly, the outsides of the thighs are speckled with grey and black, like the sides of the body, and without any tinge of red; the backs of the thighs, however, are pale reddish and unspeckled. Only about three inches of the root of the tail are red, and the transition from the red to the greyish black is much more abrupt than in *C. stairsi stairsi*.

Loc. Mozambique.

A single male specimen received from Mr. Hintz by the Society on June 7th, 1893. There is no evidence, let alone proof, that the differences in colour between this specimen and the typical form are attributable to age or individual variation. The two may be distinguished as follows:—

a. Red on head extending behind ears and on to occipital area; sides of the body washed with yellowish red, outer surface of posterior limbs reddish, unspeckled .... Subsp. *stairsi*.

a'. Red on head practically limited to a pair of patches in front of the ears; sides of body and external surface of posterior limbs speckled grey .... Subsp. *mossambicus*.

CERCOPITHECUS RUFOTINCTUS, sp. n.

Cercopithecus stairsi P. L. Sclater, P. Z. S. 1896, p. 609.

♀. Distinguishable from *C. stairsi* by having a reddish tint generally diffused over the upper portion of the head, without distinct definition of the preaural patches; also in having the cheeks and the long hairs which grow backwards over the sides of the neck beneath the ears decidedly washed with red—in fact, differing but little from the top of the head but very strongly from the shoulders in colour. The dorsal area and the sides of the body are much redder than in the type of *C. stairsi mossambicus*. In this respect the specimen approaches the male of *C. stairsi stairsi* but the hairs are distinctly annulated down to the root of the tail. The shoulders and arms are blacker than in the other specimens, and the outer sides of the legs are grizzly black, as in *C. stairsi mossambicus*, but darker, and not reddish yellow as in *C. stairsi stairsi*.

Loc. British East Africa (? Mombasa).

A single female specimen was presented to the Society by Mr. J. W. W. Pigott on Sept. 20th, 1895.

This form should perhaps take rank only as a subspecies of *C. stairsi*. The type, however, differs more from the types of the two subspecies of *C. stairsi* than they do from each other.

CERCOPITHECUS FRANCESCÆ Thos.

Cercopithecus francescæ Thomas, Ann. Mag. Nat. Hist. (7) x. p. 243, 1902.

Coat long and thick. Prevailing colour of head, shoulders, and sides of body blackish, speckled with grey, the black predominating. Over a definite area of the back from well behind the shoulders to the root of the tail, the speckling is distinctly yellow, but the yellow does not spread on to the sides of the body nor on to the thighs, the blackish colour of which passes gradually into the more distinctly speckled tint of the sides of the body. Ventral surface, inside of thighs, and chest sooty or smoke-grey. Throat and sides of neck up to the level of the lower edge of the ear whitish. Hair on ears with a more decided reddish tinge than is seen in any species of this section.

Loc. Near the Mount Waller plateau, Lake Nyasa. Reg. no. in B.M. 2.7.24.1.

A much smaller Monkey than *C. albogularis*, with reddish hair on the ears and the yellow speckling in the fur confined to the dorsal area of the posterior half of the body.

CERCOPITHECUS PREUSSI Matschie.

Cercopithecus preussi Matschie, SB. Ges. nat. Fr. Berlin, 1898, p. 76.

Cercopithecus crossi Forbes, Nature, vol. lxxii. p. 630, 1905.

Head, neck, shoulders, and sides of body blackish, speckled with grey, no yellow in the hair of the whiskers or head. The dorsal area of the body between the shoulders and the root of the tail black, speckled with reddish brown, the reddish annuli in the hair much narrower than the black. Tail speckled reddish at the root, the terminal half black, the intervening area dark but speckled with grey. External surface of thighs blackish, speckled, passing gradually into the darker hue of the sides of the body, the hairs of which, at all events inferiorly, have no red in the grey speckling. Ventral surface dark smoke-grey, sometimes with indistinct speckling. Throat and sides of neck up to the level of the lower border of the ear whitish grey. Between the eyes a line of black hair which expands on the nose into a triangular black patch and extends thence inferiorly over the upper lip. The whisker-hairs adjacent to the face greyish at the base. Hair on ears mostly black.

Loc. Cameroons (*Matschie and Forbes*); also Fernando Po, in B.M. reg. nos. 4.7.1.5-7.

A young specimen in the British Museum gives the following measurements:—Head and body 262 mm., tail 315 mm.

A much darker form than *C. albogularis,* with the rufous speckling of the back not extending so far inferiorly, and with black hair on the nose, lips, and ears.

Cercopithecus labiatus Geoffr.

Cercopithecus labiatus Is. Geoffr. St. H., C. R. xv. p. 1038, 1842; id. Dict. d'Hist. Nat. iii. p. 302, 1849; Schlegel, Mus. Pays-Bas, vii. p. 79, 1876; Matschie, SB. Ges. nat. Fr. Berlin, 1893, p. 214; Forbes, Monkeys, ii. p. 72, 1894.

Cercopithecus samango Sundev. Œfv. K. Vet.-Akad. Förh. i. p. 160, 1844; P. L. Sclater, P. Z. S. 1893, p. 251; W. L. Sclater, Fauna S. Afr., Mamm. i. p. 9, fig. 2, 1900.

Coat long and thick, dark-coloured, black, speckled with yellowish grey, the back and sides of the body not more brightly coloured than the fore part, the black bands in the hair much wider than the pale. Top of head blacker than nape of head and cheeks. No half-collar on sides of neck. Tail with its basal third almost white below and laterally, the pale area much exceeding in width the pigmented area, which is confined to the dorsal surface; median portion of tail dark grey above and below, terminal portion black. Fore leg jet-black from above the elbow. Hind leg smoky grey, speckled with yellow, not sharply defined from the tint of the sides of the body; the hair external to the callosities grey tinged faintly with reddish, a little of that tint extending on to the root of the tail. Ventral surface from the chin to the pubic area whitish ashy grey, unspeckled, the same pale hue spreading over the inside of the thighs.

Loc. S. Africa: King Williamstown and Pondoland (*W. L. Sclater*). Also said to occur in Natal, Zululand, and Angola.

The description given above is taken from a specimen ticketed S. Africa, and presented to the Society in 1888. A second specimen received in 1906 resembled it in all important particulars. The pale colour of the under side of the proximal end of the tail of this species distinguishes it at once from the rest of the species of the Albogularis-section. The uniformity in the tint of the speckling of the dorsal surface from the head to the root of the tail is another distinctive feature.

The MONA-group.

Mona Reich.; *Mona* + *Otopithecus* Trouess.

Pale colour of inner side of arms sharply contrasted, especially along the radial aspect, with the black or dark grey tint of the outer side. A black temple-band extending from eye to ear and sharply separating the colour of the cheek from that of the summit of the head. A well-defined pale brow-band, which sometimes extends over a large part of the summit of the head. Face slate-blue, but median area of lips flesh-coloured. Shoulder and anterior portion of back redder or greyer than the posterior area, which tends to turn black.

Distr. From Sierra Leone through the Gold Coast, Nigeria, and the Congo to the Ituri Forest.

Key to the Species and Subspecies.

a. Ventral surface at least laterally and at least the margins of the limbs suffused with rusty yellow; hairs on ears rusty yellow.

b. Outer side of hind limb from hip to ankle rusty, the colours of the thigh and sacral area sharply defined; throat and chest white; red on the belly and on the inner side of the limbs pronounced only where the white passes into the coloured outer or lateral surface .... *wolfi.*

b′. Outer side of hind limb usually greyish, sometimes suffused with yellow, but the colours of the thigh and sacral areas not sharply defined from each other; the entire ventral surface (at least in the adult) yellowish or rusty red.

c. Arms externally speckled, not black; a jet-black band considerably more than twice as long as broad and sharply defined laterally from the greyish lateral surface extending from behind the shoulders to the rump; no distinct double or U-shaped pale mark on the head .... *pogonias.*

c′. Arms black; a black patch on lumbo-sacral area, if present, not sharply defined laterally and not twice as long as broad; a decided U-shaped pale patch on the head. *grayi.*

d. Lumbo-sacral area of dorsal surface jet-black .... Subsp. *nigripes.*

d′. Lumbo-sacral area usually reddish, speckled; sacral area sometimes jet-black .... Subsp. *grayi.*

a′. Ventral surface, throat, and inside of limbs white at all ages; hairs on ears usually speckled.

e. A conspicuous white patch on each side near the root of the tail .... *mona.*

e′. No white patch near root of tail.

f. Outer surface of hind legs and more or less of the lumbo-sacral area black or dark grey and scarcely speckled, contrasting with the fore part of the dorsal surface.

g. Brow-patch white and cheeks and side of neck pale greyish, gradually passing into the white of the throat, as in *C. mona*; hairs on ear speckled .... *campbelli.*

g′. Brow-patch yellow usually, ill-defined, but spreading backwards over forehead; cheeks and side of neck dark dusky greyish green, sharply defined from white of throat; hairs on ear yellowish .... *burnetti.*

f′. Outer surface of hind legs and the lumbo-sacral area much the same colour as the fore part of the dorsal surface—that is to say, speckled red and black .... *denti.*

By Sclater and Forbes the two species *C. mona* and *C. campbelli* were placed in a group containing *C. albogularis*, *C. leucampyx*, and the rest of the black-armed species without a nose-spot. Neither of these authors appears to have detected either the close similarity between these two species, or the obvious affinity they exhibit towards *C. wolfi*, *C. pogonias*, and *C. grayi*; and in spite of Pousargues's remarks upon this point (Ann. Sci. Nat. (8) iii. p. 215, 1896), Trouessart (Cat. Mamm. Suppl. pp. 13, 14, 1904) adheres to the views implicitly expressed by the earlier writers.

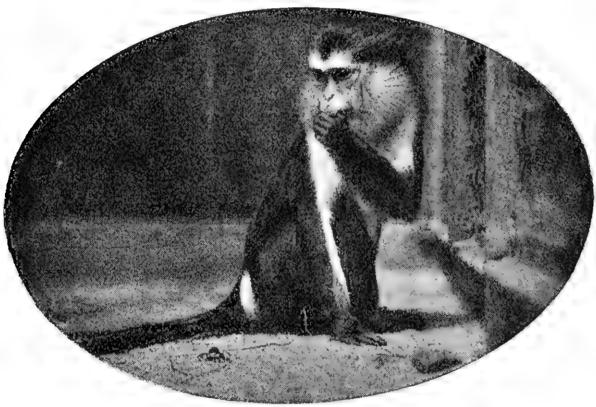
CERCOPITHECUS MONA Schreb. (Text-fig. 184.)

Simia mona Schreber, Säug. i. p. 97, pl. xv., 1774.

Cercopithecus mona Erxleben, and of subsequent authors.

Brow-band whitish, broader laterally than mesially, but not extending to the ear. Head and nape speckled yellowish green; whiskers greyish, apically annulated with yellow and black. Ear-tufts long, thick, of the same colour as the hairs of the nape.

Text-fig. 184.



Cercopithecus mona Schreber.

(From a specimen living in the Society's Gardens.)

Back, shoulders, and sides of body speckled, rusty red; lumbo-sacral area darker, sometimes almost black. Arms black externally: legs blackish, sparsely and weakly speckled externally; hands and feet black. An elongate patch of snow-white hair extending forwards from the ischial callosity on to the hip. Tail nearly black, greyish on under side in proximal half. Chin, throat, chest, belly, inside of arms and legs white.

Loc. Nigeria and Cameroons. The British Museum has examples of this species from Jebba on the Niger (*G. F. Abadie*, 0.3.29.2); Bakana, Southern Nigeria (*W. J. Ansorge*, 2.11.2.2–3.).

Of the large number of skins of this species—one of the commonest of African Monkeys in captivity—possessed by the Society, not one has a definite locality.

CERCOPITHECUS CAMPBELLI Waterhouse. (Plate XL. fig. 1.)

Cercopithecus campbelli Waterhouse, P. Z. S. 1838, p. 61; not of subsequent authors, or, at least, only in part.

Closely allied to *C. mona*. Forehead with a large white or silver-grey brow-band extending laterally further towards the ears than in the middle, where it is partially divided. Cheeks greyish, tinged with yellow and faintly speckled with black, the hair gradually losing this tint inferiorly and on the neck, where the colour fades imperceptibly away into the uniform greyish-white colour of the throat. Hairs on ear like those on head, speckled yellow and black. Head and shoulders speckled yellow and black, the head rather yellower than in *C. mona*, and the shoulders less rusty brown. Behind the shoulders and on the arm the speckling gradually dies out of the hairs, which, at least on the lumbo-sacral area, are of almost a uniform greyish black, as also are the outsides of the thighs. Tail at base blackish above and below, and the same colour as the sacral area; following the black basal portion it is speckled above, grey below; its distal end is black.

Loc. Sierra Leone.

The type of this species came from Sierra Leone. In the British Museum there are three flat native-prepared skins: one labelled Sierra Leone (*Mr. Fraser*, 45.9.6.1); a second ticketed Buyabuya, Little Scarcies River inland of Sierra Leone (*G. F. Scott Elliot*, 92.6.7.2); and a third without locality (Zool. Soc. 55.12.24.408). I have also seen the skin of a young female specimen which formerly lived in the Gardens. It has no exact locality.

C. campbelli is in some respects intermediate between *C. mona* and *C. burnetti*. It is evidently a Monkey which is rarely captured or killed by Europeans.

CERCOPITHECUS BURNETTI Gray. (Plate XL. fig. 2.)

Cercopithecus burnetti Gray, Ann. Mag. Nat. Hist. x. p. 256, 1842.

Cercopithecus campbelli Sclater, Forbes (*nec* Gray).

This species differs from *C. campbelli* in having the forehead yellowish in front and the patch not so sharply defined; the cheeks and sides of the neck as far back as the black of the shoulders are olive-grey, speckled and strongly contrasted with the relatively narrower white area of the throat; the ear-fringe is reddish yellow and stands out against the colour of the back of the head without blending with it; the posterior region of the body is blacker and not a dark slate-grey.

Loc. Gold Coast to the Cameroons.

The British Museum has a skin of this species, a young example, ticketed Cameroons (*Capt. Burton*, 82.6.12–1). Two specimens that lived recently in the Gardens came respectively from Ashanti and Accra.

In the collection of the Society there are a large number of skins of various ages, labelled W. Africa, most of which were identified by Dr. Sclater as *C. campbelli*. Living examples are far more commonly procured than are those of the veritable *C. campbelli*. One or more may usually be seen in the Society's Gardens.

C. burnetti Gray, alleged to be from Fernando Po, is added to the synonymy of *C. campbelli* by both Sclater and Forbes, who described the present species under that name. The description of *C. burnetti* runs as follows :—" Greyish black ; head, neck, and upper part of back yellow dotted ; throat, cheek, abdomen, inner side of fore legs and thighs greyish white ; face black ; hair of cheek and forehead yellow, with a small tuft of black hair over each eye ; fur very thick ; hairs long, rather rigid, pale at the base, then greyish black ; those of the head, neck, and upper part of the back and base of the tail with two or three broad yellow-brown subterminal bands. Length of body and head 19 inches."

This description cannot be said to fit accurately the species here identified as *C. burnetti*, but I think it may be regarded as probable that Gray had a specimen of that species in his hands when he described *C. burnetti*.

CERCOPITHECUS DENTI Thos.

Cercopithecus denti Thos. P. Z. S. 1907, p. 2, pl. i.

Brow-band not very well defined, consisting of hairs white at the base and banded apically. Ears with white hairs. Summit of head to shoulders grizzled greenish ; sides of head and neck greener than head and nape. Back and upper part of sides brownish, the hairs banded with black and red. Tail pale beneath, greyish above, black at the distal end. Fore leg externally grizzled greenish to elbow, black from elbow to hand. Hind leg from the hip to the ankle speckled, yellower than lumbo-sacral area ; distal half of foot black. Under side and inside of limbs white, the white of the belly passing halfway up the sides, and everywhere, both on the limbs and body, very sharply defined from the pigmented areas.

Loc. Ituri Forest.

CERCOPITHECUS WOLFI Meyer.

Cercopithecus wolfi Meyer, Notes Leyden Mus. xiii. pp. 63–64, 1890 ; P. L. Sclater, P. Z. S. 1893, p. 258 ; Meyer, P. Z. S. 1894, p. 83, pl. vii. ; Forbes, Monkeys, ii. p. 79, 1894.

Loc. Congo.

Meyer's description of this species is so full and exact that no repetition of it is necessary. The characters are also well shown in the plate in the 'Proceedings of the Zoological Society' for 1894.

The exact locality of the type was not known; but in August, 1904, a beautiful example of the species, obtained by Mr. J. D. Hamlyn in Brazzaville, on the Congo, whither it was brought by natives, was deposited in the Zoological Gardens by the Hon. Walter Rothschild.

Dr. Forbes quite correctly placed this species in the same category as *C. grayi*. In this he has been followed by Trouessart.

The most distinctive characteristics of the species are:—the extension of the white brow-band laterally as far as the ears; the reddish-brown colour of the hind legs from the hip to the ankle, the hairs of this limb, however, are distinctly speckled with black; the presence of an ill-defined dorsal blackish band and of a considerable quantity of yellow in the hairs on the sides of the body and on the belly, and bordering the white of the inner side of the limbs.

Cercopithecus grayi Fraser.

Subsp. grayi Fraser.

Cercopithecus grayi Fraser, Cat. Knowsl. Coll. p. 8, 1850; Matschie, SB. Ges. nat. Fr. Berlin, 1893, p. 214; Forbes, Monkeys, ii. p. 77, pl. xxiii., 1894 (bibliography).

Cercopithecus erxlebeni Dahlb. & Puch. Rev. Mag. Zool. 1856, p. 96.

Brow-band greatly developed and extending backwards on to summit of head as a pair of whitish patches, separated mesially by a narrow area of blacker hair. A broad black band across the temple. Cheeks speckled with greenish yellow and black. Ear-fringes long, yellowish red, standing boldly out against the background of the head and neck. Dorsal surface uniformly rusty red nearly all over, jet-black on sacral region, yellower on nape of neck; the sides sometimes greyer (in the male); arms black externally; legs greyish, speckled down to ankles; hands and feet black. Tail mostly black, reddish in its basal half below. Under side from chin to pubic region and inside of limbs rufous yellow.

Loc. The British Museum has specimens from the following localities:—Efulen in the Cameroons (*G. L. Bates*, 96.3.20.1); Benito River, Congo (*G. L. Bates*, 0.2.5.4–6); Gaboon (*Laglaize*, 80.6.7.2).

Pousargues, who, perhaps rightly, regarded *C. pogonias*, *C. erxlebeni*, and *C. nigripes* as synonyms, and at most as representing local races, records specimens from various places in the French Congo, namely from Ogoué, Mayumbé, Bangui, and Ouadda, Upper Oubangui. With the exception of the specimen from Mayumbé, none of these showed traces of black on the back.

Pousargues and Trouessart reject the name *grayi* for this species, alleging that no description accompanied its first publication. This is an error. Fraser gave a good though brief diagnosis of the species in the work cited above.

Three adult specimens from the Benito River taken at sea-level, 20 miles from the coast, gave the following measurements in the flesh:—

♂.	Head and body 525 mm.,	tail 750 mm.
♂.	„ „ 547 „	„ 870 „
♀.	„ „ 440 „	„ 785 „

According to Bates the Fang name is "Shumé."

Judging from some skins, without definite locality, in the collection of the Zoological Society, the under side and inner surface of the limbs are much whiter, in some cases, indeed, almost untinged with yellow in immature forms.

Subsp. NIGRIPES Du Chaillu.

Cercopithecus nigripes Du Chaillu, P. Bost. N. H. Soc. vii. p. 360, 1860.

Loc. Gaboon (*Du Chaillu*, 61.7.29.16 in B.M.).

The single skin of this form that the British Museum possesses is only distinguishable from typical representatives of *C. grayi*, as exemplified by the specimens from the Benito River, by the greater amount of black over the lumbo-sacral area. In this particular *C. nigripes* is nearly intermediate between the typical *C. grayi* and *C. pogonias*; but in the latter the black shield is sharply defined along its edges and relatively much longer as compared with its width.

CERCOPITHECUS POGONIAS Bennett.

Cercopithecus pogonias Bennett, P. Z. S. 1833, p. 67; and of most subsequent authors.

Allied to *C. grayi*. No lateral white or yellowish-white stripe on the head above the temple-stripe. Head, neck, shoulders, fore legs, and sides of body speckled yellow and black, with more grey in the hair on the sides of the body than on the shoulders. The entire dorsal area behind the shoulders covered with a broad band of jet-black hair, imperceptibly blending with the speckled hair of the shoulders in front, but very sharply defined from the greyish-speckled hue of the sides of the body. Outer side of thighs greyish, tinged with yellowish red. The entire under surface and the inside of the limbs are rusty red. The basal half of the tail is red beneath, black above, and the terminal half is wholly black.

Loc. Exact locality unknown. Said to be Fernando Po.

The above-given description is taken from two flat native-prepared skins in the British Museum. They appear to agree with the example described by Bennett, a very young thick-coated specimen mounted in the British Museum, except in the definition of the dorsal black area. In Bennett's specimen the shield is smaller and only sharply defined on the sacral area.

Pousargues records a specimen referable either to typical *C. pogonias* or to *C. grayi nigripes* from Cette Cama.

The L'HOESTI-group.

This section, containing the single species *C. l'hoesti*, resembles *C. opisthostictus* of the Leucampyx-section in the blackness of the legs, shoulders, and belly, and in a lesser degree of the head. The rufous dorsal area, on the other hand, recalls the Albogularis-group. From the latter, however, as well as from all the species of the Leucampyx-section, it differs entirely and resembles the typical *C. æthiops* of the Æthiops-section in the upward direction and snow-white colour of the longish cheek-hairs. The white throat and whiskers, as well as the direction of growth of the latter, and the thickish clothing of black hair on the nose suggest affinity with *C. erythrogaster*.

Cercopithecus l'hoesti Sclater.

Subsp. l'hoesti Sclater. (Plate XLI. fig. 2.)

Cercopithecus l'hoesti P. L. Sclater, P. Z. S. 1898, p. 586, pl. xlviii.; Matschie, SB. Ges. nat. Fr. Berlin, 1905, pt. 10, pp. 262–264.

Face (dry skin) black; nose thickly, lips more sparsely clothed with black hairs; area of face below the eye clothed with a mixture of short black and white hairs, which posteriorly become longer and run up over the whiskers. The latter white, long, and directed upwards and backwards to form a thick fringe between the face and the ear, partially concealing that organ and continued on to the sides of the neck behind it. The throat and posterior half of the interramal area white like the cheeks, the white continued posteriorly in a narrow point as far back as the mammæ. Summit of head black, but the whole of its median area, like that of the nape of the neck and the sides of the area between the shoulders and the sides of the body above the belly, speckled with greyish white. On the middle of the area between the shoulders begins a band of hairs speckled black and orange-red, which gradually expands posteriorly over the costal and lumbar regions and dies away upon the hip and towards the root of the tail, the orange-red in the hairs being in these places replaced by grey. Tail for the most part grey speckled with black, its distal third blacker, quite black at the end; also about four inches of the under side at the base black. The shoulder and fore limb, the hip and the hind limb jet-black outside and inside. The entire ventral surface black with a tinge of brown from the clavicular region to the anus, with exception of the above-mentioned white median angular area on the fore part of the chest.

Loc. Chepo or Tschepo in Congoland.

A single adult ♀ (type) from the above-mentioned locality, which lived in the Society's Collection from July 1898 to March 1902.

Unless the specimen changed considerably in colour during captivity, which is not impossible, the original description is inexact.

Dr. Sclater, for example, applied the term "cinereous" to the belly, limbs, and tail, the tail being said to be blackish below. The tail is, as a matter of fact, heavily speckled with grey throughout the greater part of its length, being greyer below than above, except at the base and apex, and the limbs and belly show no trace of grey speckling to account for the epithet "cinereous."

According to Matschie there is a specimen of this Monkey from Tschepo in the Tervueren Museum.

Subsp. THOMASI Matschie.

Cercopithecus thomasi Matschie, SB. Ges. nat. Fr. Berlin, 1905, p. 262.

So far as I can determine from the description, this form, to which Matschie gives full specific rank, differs from the typical form in being chestnut-red above, in having a much more distinct band of greyish-white hair below the eyes, and in the extension of the white on the chest to about the middle of the sternal area.

Loc. East shore of Lake Kivu between Lakes Tanganyika and Albert Edward.

THE ERYTHROGASTER-GROUP.

CERCOPITHECUS ERYTHROGASTER Gray. (Plate XLI. fig. 4. Text-fig. 185, p. 716.)

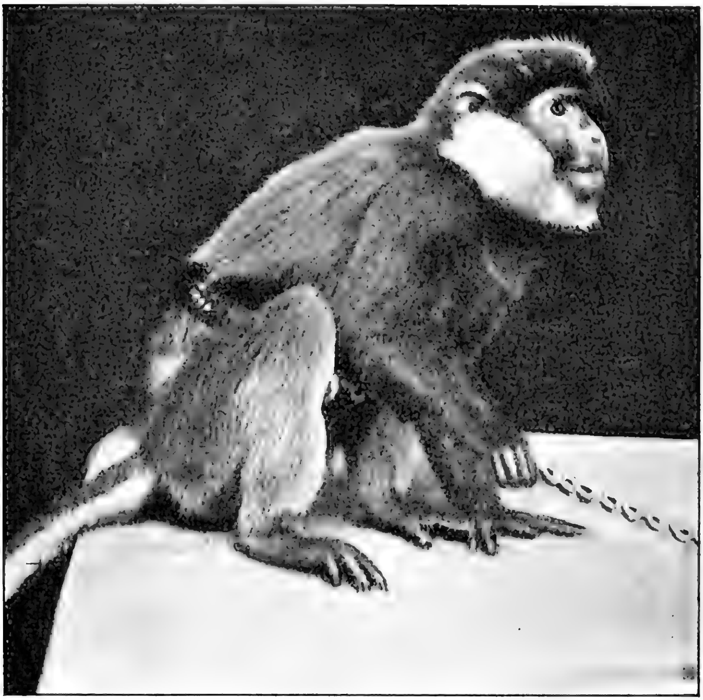
Cercopithecus erythrogaster Gray, P. Z. S. 1866, p. 169, pl. xvi.; id. Cat. Monkeys Brit. Mus. p. 128, 1870; Murie, P. Z. S. 1866, p. 380; Schlegel, Mus. Pays-Bas, vii. p. 69, 1876; P. L. Sclater, P. Z. S. 1893, p. 252; Matschie, SB. Ges. nat. Fr. Berlin, 1893, p. 226; Pousargues, Mém. Soc. Zool. Fr. vii. p. 71, 1894; Sclater, P. Z. S. 1894, p. 1; Forbes, Monkeys, vol. ii. p. 46, 1894; Pousargues, Bull. Mus. Paris, iii. p. 52, 1897.

Skin of face round eyes bluish grey, lips and chin pinkish grey. Nose clothed with black hairs, which, at least in some cases, apparently turn white in the adult. Crown of the head speckled golden green and encircled with a continuous black brow, temple, and parieto-occipital stripe. Below the temple-stripe a conspicuous greyish-speckled patch close to the face, and beneath the latter a smaller black patch near the corner of the mouth, which is continued backwards and upwards in the direction of the ear. The area of the cheek below this and the throat covered with a thick mass of longish white whiskers. The entire dorsal surface uniformly coloured blackish speckled with yellow, darker than the head. Outer side of fore limbs with evanescent speckling, nearly black; hands blacker; of hind limbs blackish grey but speckled; feet black. Upper side of tail like the back; under side greyish white; chest and belly rusty brown; inside of fore legs blackish grey; of hind legs greyish white.

Loc. Lagos (sec. *Pousargues*).

This species was based upon a young specimen showing no trace of the white nasal patch characteristic, as was afterwards shown, of some adults. In 1893 Sclater, to whom only the young was known, classified the species in his "melanochirine" section; but in the same year Matschie pointed out its affinity to the "spot-nosed" group. This observation was corroborated in 1894 and again in 1897 by Pousargues, who added to our knowledge of the species the fact that the nasal field is completely naked in the young individual and covered with white hairs in some adult examples. In the type specimen, as asserted by Sclater, the area

Text-fig. 185.



Cercopithecus erythrogaster Gray.

(From a specimen living in the Society's Gardens.)

in question is clothed with black hairs with whitish bases. Hence it seems probable that the condition of this specimen represents a stage intermediate between that of the naked-nosed young and of the white-nosed adult observed by Pousargues. There is, however, an example (text-figure 185) now living in the Gardens which appears to be almost or quite adult and the nose is jet-black.

Pousargues placed this species in close proximity to *C. petaurista*, which is probably its nearest ally, as is shown principally by the arched inferior cheek-stripe and the extension of the white of the chin and throat up to the ear forming white whiskers. The differences between the species are, however, very marked, especially in the redness of the belly, the very conspicuous grey patch on the cheek adjacent to the face, the blackness of the nose until maturity or old age is reached, and the marked difference in colour between the under side of the body and the inside of the limbs in *C. erythrogaster*.

The PETAURISTA-group.

Rhinostictus Trouess.

Skin of face round the eyes slate-blue or blackish; of lips pale bluish grey. Usually, probably always in the adult, a distinct black brow-band continuous with a black band extending across the temple on each side backwards to the ear. Area between the eyes with a strip of black hair, which expands on the nose and is confluent with a large cordate white patch narrowing below between the nostrils and transverse, convex, or mesially emarginate above. Dorsal surface from occiput to tail almost uniformly coloured, black speckled with greyish or reddish yellow. Ventral surface from chin to pubic region white or greyish white, paler on inner than on outer side of limbs; pale area on inner side of upper arm sharply contrasted with the darker tint of the outer side. Lower surface of tail pale, at least in its proximal portion, and sharply defined in colour from the upper surface.

Distr. From Liberia and Angola eastwards up the Congo Valley to Uganda.

Key to the Species and Subspecies.

a. White of the throat extending upwards on to the cheek almost to the level of the top of the ear, the hairs growing upwards and backwards, and bordered by an upwardly-arched black stripe running from the upper lip beneath the ear; arms speckled to the wrist .... *petaurista.*
- *b.* A black band, more or less developed, crossing the back of the head; no distinct patch of greyish-yellow hair on the cheek below the eye .... Subsp. *petaurista.*
- *b'.* No black band crossing the back of the head; a distinct patch of greyish-yellow hair on the cheek below the eye . Subsp. *buttikoferi.*

a'. White of the throat not extending up on to the cheek; the hairs, at least of the lower portion of the cheek, growing downwards and backwards; arms black to the wrist.
- *c.* Hairs of the cheek yellowish or whitish and marked off from those of the throat by a more or less well-defined black stripe running straight backwards from the upper lip beneath the ear .... *ascanius.*
  - *d.* Black stripe crossing the lower portion of the cheek broad and expanding on the face adjacent to the upper lip; hairs on ears red .... Subsp. *ascanius.*
  - *d'.* Black stripe crossing lower portion of cheek narrow and fading away towards the corner of the mouth; hairs on ears white .... Subsp. *schmidti.*
- *c'.* Hairs on the cheeks speckled like those on the top of the head; no inferior stripe on the cheek .... *signatus.*

CERCOPITHECUS PETAURISTA Schreber.

Subsp. PETAURISTA Schreb.

Simia petaurista Schreber, Säug. i. p. 103, pl. xix. B, 1775.
Cercopithecus petaurista Erxleben, and of subsequent authors.
Cercopithecus fantiensis Matschie, SB. Ges. nat. Fr. Berlin, 1893, p. 64.

Brow-band and temple-band well developed, the latter extending round the back of the head as a parieto-occipital stripe. The anterior part of the cheek and the adjacent area of the face down to the corner of the mouth continuously clothed with jet-black hairs. Some little distance behind the corner of the eye on the temple there is a whitish stripe, which runs obliquely backwards and downwards beneath the ear; and underlying this there is a conspicuous black stripe, which passes downwards and backwards from the black anterior portion of the cheek on to the side of the neck. The white of the throat runs up on the cheek considerably above the corner of the mouth as high as a point on a level with the bottom of the ear, the hairs being directed obliquely upwards and backwards. The black hairs of the cheek just in front of this uprunning white area are also directed upwards and backwards. The top of the head, the neck, shoulders, back, and limbs speckled, the head, neck, and limbs being yellower or greener and distinctly less red than the back. The tail speckled throughout above; greyish white below.

Loc. Gold Coast: Sekondi (in Zool. Soc., *Dr. Carew*); Rio Bontag, Cape Coast (type of *fantiensis*).

Subsp. BUTTIKOFERI Jent. (Plate XL. fig. 6.)

Cercopithecus buttikoferi Jentink, Notes Leyden Mus. viii. p. 56, 1886.

Distinguishable from the typical form *C. p. petaurista* by the characters indicated in the key, namely by the absence of the parieto-occipital black band and the presence of a patch of greenish speckled hairs on the cheek adjacent to the face just below the eye. But since some examples I refer to *C. p. petaurista* have indications of this last-mentioned patch, and since the black parieto-occipital band varies greatly in the degree of its development, these two features must be regarded, I think, as of subspecific value. It may be added that Dr. Jentink does not mention the presence of the pale facial patch in his description of *C. buttikoferi* *. It is, however, present in all the examples that I refer to this form, and was, I presume, overlooked as a distinctive feature when the original diagnosis was compiled.

Loc. Liberia.

* Sir H. H. Johnston possibly detected this difference, for he says that *C. buttikoferi* differs most markedly from *C. petaurista* in having a long white mark over the ridge of the eyebrows, stretching from the bridge of the nose right across the face to below the ear ('Liberia,' ii. p. 679). This description, however, does not fit examples of this Monkey I have seen.

CERCOPITHECUS ASCANIUS Aud.

Subsp. ASCANIUS Aud. (Plate XL. fig. 5. Text-fig. 186.)

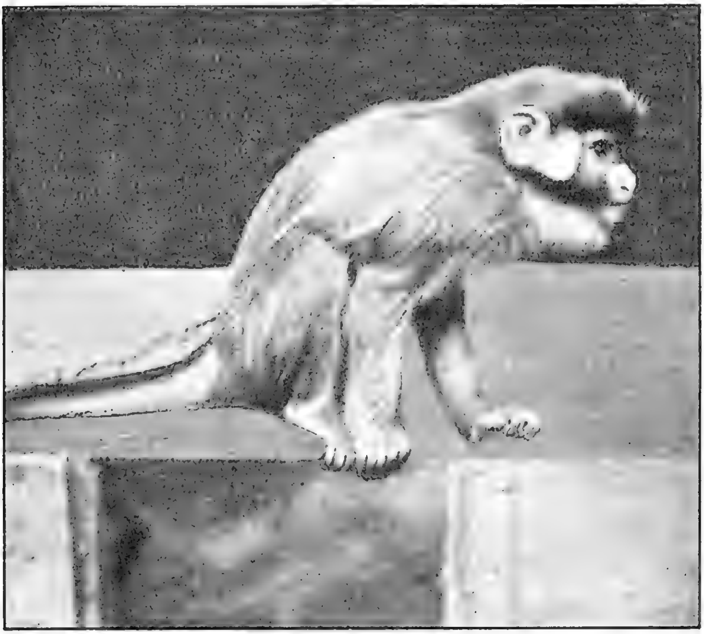
Simia ascanius Audebert, Hist. Nat. Singes, fam. IV. sect. ii. pl. xiii., 1799.

Cercopithecus melanogenys Gray, Ann. Mag. Nat. Hist. xvi. p. 212, 1845; id. P. Z. S. 1849, p. 7, pl. ix. fig. 2.

Cercopithecus histrio Reichenbach, Affen, p. 106, pl. xviii. figs. 256–257, 1863.

Cercopithecus picturatus Santos, Jorn. Sci. Lisboa, xi. p. 98, 1886.

Text-fig. 186.



Cercopithecus as canius Aud.

(From a young specimen living in the Society's Gardens.)

At once distinguishable from *C. petaurista petaurista* and *C. p. buttikoferi* by the colour and arrangement of the hair on the cheek. There is typically a black brow-band extending across the forehead and backwards to the ear, but not over the back of the head. Beneath this, in front of the ear upon the cheek, there is a large patch of yellowish-white hair arranged radially in a whorl, and below this whorl a large black stripe extends from beneath the ear, where it is thinnest and palest, forwards on to the sides of the face between the corner of the mouth and the eye. Hairs on the ear pale red. Fore leg blackish, only sparsely and faintly speckled. Hind leg also blacker than in *C. petaurista*. Tail red above and below in the distal three-fourths of its length, whitish-grey below at the base, and for a couple of inches above at the base the same colour as the back.

Loc. The Congo; Oubangui and Adima (*Pousargues*) to Angola; Encôge, south of Bemba*; Quimpampala (*Santos*).

I have seen several young examples referable to this species, but for none of them was a definite locality known. All were imported by dealers and deposited in the Gardens by the Hon. Walter Rothschild. They exhibited considerable variability in the width of the black stripe on the cheek, and also in the stripe crossing the brow and temple. In typical *C. melanogenys* the whole area of the cheek between the eye and the corner of the mouth is black, and the brow and temple-bands are well defined. In the Zoological Society's Collection there is a skin, dated 14.8.1900 to 21.7.1901, which very nearly agrees with this; but in a small example now living in the Gardens the black area below the eye is interrupted by a conspicuous patch of yellow-speckled hair, reducing the extent of the black area, and the temple-band is hardly developed. In another that died about eighteen months ago the black band was still further reduced both in length and width, the temporal and brow bands were practically absent, and the nose-spot was tinted with yellow. These facts indicate the probability of the existence of two or more unnamed subspecies; and since the specimens are intermediate between typical examples of *C. ascanius* and of *C. schmidti*, they have influenced me in concluding that the latter form is an East African subspecies of the former. Were it not for the presence of red instead of white hairs upon the ears, I should have been in doubt to which of the two forms to refer the above-mentioned specimens.

Subsp. SCHMIDTI Matschie. (Plate XL. fig. 4.)

Cercopithecus schmidti Matschie, Zool. Anz. 1892, p. 161; P. L. Sclater, P. Z. S. 1893, p. 245, pl. xvi.; Johnston, Uganda, i. pp. 363, 364, and p. 421, coloured plate facing p. 364.

Differs from the typical form of *C. ascanius* in having a fringe of long white hair on the ears, and in that the hairs on the cheek adjacent to the face beneath the black temporal stripe and backwards beneath the ear are greyish yellow and weakly annulated apically; they are directed downwards and forwards or backwards (in dried skins), and form a thick crest with the hairs of the area below, which grow obliquely upwards and backwards from the corner of the mouth and, being thickly annulated with black, form a dark stripe extending beneath the ear to the neck. None of the examples that I have examined have, on the cheek, the distinct radiating whorl of yellowish hair noticeable in typical *C. ascanius*.

* Monteiro, P. Z. S. 1860, p. 112.

In the British Museum there are specimens of this local race from the following localities:—Uganda (*F. J. Jackson*, 99.8.4.1; *Capt. H. J. Nadorhr*, 98.10.10.1); Port Alice (*H. H. Johnston*, 1.8.9.16); Manyema (*Beche Coll.*, 93.1.1.1); Bumba, Upper Congo (*Capt. Weyns*, 1.5.4.1).

CERCOPITHECUS SIGNATUS Jentink. (Plate XL. fig. 3.)

Cercopithecus martini P. L. Sclater, P. Z. S. 1884, p. 176, pl. xiv.; 1893, p. 245 (*nec* Waterh.).

Cercopithecus signatus Jentink, Notes Leyden Mus. viii. p. 55, 1886; Pousargues, Ann. Sci. Nat. (8) iii. p. 206, 1896.

A well-marked species of this group and most nearly allied to *C. ascanius schmidti*, but distinguishable at once by the colour and direction of growth of the hairs on the cheek. The black brow- and temple-bands are well developed. The area of the cheek beneath the latter, down to a line on a level with the corner of the mouth, is covered with hairs speckled greenish yellow and black and of the same colour as those on the top of the head, and directed obliquely downwards and backwards. Low down on the cheek they gradually blend with the white of the throat. On the anterior part of the cheek adjacent to the upper lip there is a single rather conspicuous black patch. Hairs on ear white. The top of the head and the neck are uniformly speckled yellow and black; on the back, and especially on the lumbo-sacral area, the colour is more rufous than anteriorly. Lastly the tail is not red, but coloured like that of *C. petaurista*.

Loc. W. Africa (exact locality doubtful).

In the collection of the Society there is a single skin I refer to this species. It is ticketed Fernando Po, and belonged to a female that lived about ten years in the Gardens, since it bears the dates 19.2.84 to 6.4.94. This is the example that Dr. Sclater described and figured as *Cercopithecus martini* Waterhouse. An examination of a co-type of the latter in the British Museum proves this identification to be erroneous, as Pousargues supposed. If Pousargues, however, had seen a specimen of *C. signatus* and had been acquainted with *C. buttikoferi*, he would probably have given a different classification of the "*Rhinosticti*" from that which is printed in his excellent essay on the Monkeys of the French Congo.

THE CEPHUS-GROUP.

Rhinostictus Trouess. (in part.).

Resembling the typical species of the Petaurista-group in the practically uniformly speckled colouring of the head, dorsal area, and sides of the body, and usually in the presence of a black brow-band extending backwards to the ears, and of a second black stripe separated from the former by a patch of yellowish hair, and running from the region of the upper lip for a varying distance backwards towards the lower edge of the ear; but having the throat, chest, belly, and the inside of the limbs, at least proximally, dark ashy grey and not white or greyish white. Nose-spot, when present, subquadrate or diamond-shaped.

Distr. W. Africa: Benin, Cameroons, and Congo.

Key to the Species.

a. Upper lip with a moustache of short black hairs underlying a clear pale blue transverse stripe; chin black; nose naked or clothed with pale pubescence; no black brow-band .... *cephus.*

a′. Upper lip with black hairs only towards the corner of the mouth; no blue stripe; chin pale (? flesh-coloured); nose with distinct patch of red or white hairs; a distinct black brow-band.

- *b.* Nose-patch red; ear-fringe red; no occipital stripe; some black below elbow; legs greyish black, darker than back; tail red, except above at base .... *erythrotis.*
- *b′.* Nose-patch almost wholly white; ear-fringe white; an occipital stripe; arms and legs grey, speckled, paler than dorsal surface; tail red in its proximal half beneath .... *sclateri.*

CERCOPITHECUS CEPHUS Linn. (Plate XLI. fig. 3. Text-fig. 187, p. 723.)

Simia cephus Linn. Syst. Nat. i. p. 39, 1766.
Cercopithecus cephus of most subsequent authors.

Face bluish slate-grey, with a brilliant whitish-blue stripe on the upper lip beneath the nostril extending obliquely outwards from the middle line. Beneath this a moustache of black hairs borders the lips, and expanding externally merges with the black hairs clothing the lower part of the cheek close to the face. Some black or blackish hairs also on the chin. Nose naked or clothed with pubescence, which never forms a very definite patch. Hairs on the cheek directed obliquely downwards and backwards; those just beneath the temple-stripe clear yellow, except close to the ear, where they are annulated. Beneath this patch the hairs are strongly annulated black and yellow, the black predominating near the face. Hairs on ear yellowish white. On the upper side of the head the pale annuli on the hairs are greener than those on the body, which are almost rusty red. On the outside of the limbs, too, the hairs are speckled, but the dark element is dominant, making them darker than the body; hands and feet black. Tail variable in colour, mostly coppery red or coloured much like the back above and grey below.

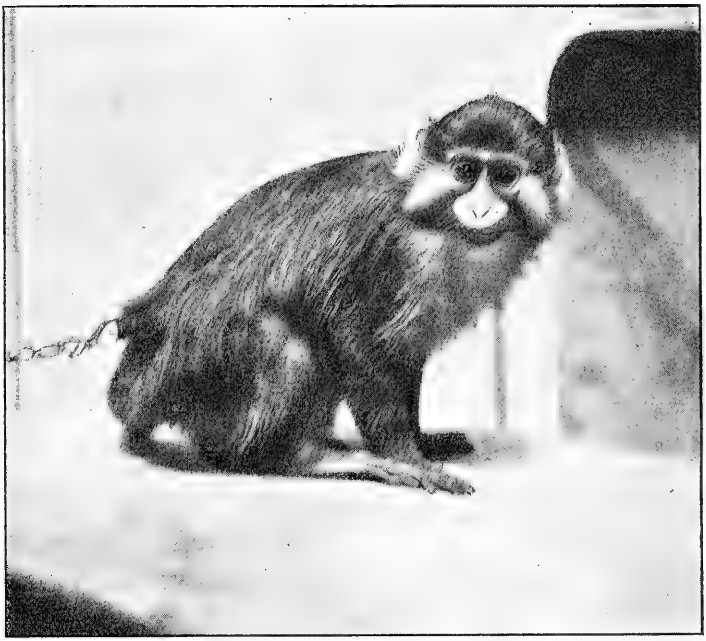
Loc. Congo and Gaboon.

The specimens of *C. cephus* that I have seen may be referred to two categories characterised by the colour of the tail, which is red in the one and the same colour as the body in the other. I do not certainly know what value in taxonomy this feature possesses. It was well known to Pousargues*, who pointed out that of the series of ten specimens in the Paris Museum all have red tails except three, which came respectively from Doumé-Ogowé (? Doumé on the Ogoué) and Mayumba, near the ocean (? sea-level), all

* Ann. Sci. Nat. (8) iii. p. 211, 1896.

being adult females. The others were an adult male from Samkitta-Ogowé (? Samkitta on the Ogoué); a very young specimen of doubtful sex, a semi-adult male, and an adult female from San Benito; an adult male from Ogoué; and two adult males from the Forest of Mayumba. That the difference is not attributable either to age or sex, is proved by the fact that all the specimens known from the Benito River and San Benito in the British and Paris Museums, whether old or young, male or female, have the tail red. Moreover, Pousargues lays stress upon the fact that all

Text-fig. 187.



Cercopithecus cephus Linn.

(From a young specimen living in the Society's Gardens.)

the specimens known to him with tails coloured like the body were females. But in the British Museum there is a male specimen, just adult, as shown by its teeth, in which the tail is also coloured in that way. This example is ticketed "Gaboon (*Laglaize Coll.*, 80.6.7.3)." In addition to this, there are two skins in the collection of the Society, ticketed W. Africa, which resemble the above-mentioned Gaboon specimen in the similarity in colour between the tail and the body. They also resemble it, and differ from the examples of *C. cephus* from the Benito River, in having a thick fringe of yellowish-white hair upon the ears, and in having a greater quantity of black in the hairs on the crown of the head.

Pousargues did not admit that any systematic importance was to be attributed to the absence of red in the tail. But his series of skins does not establish the fact that the two forms occur together in the same locality. If that were the case, I think one would be compelled to assume, from the available evidence, that *C. cephus* is dimorphic with respect to the colour of the tail. It may be so; but, pending the establishment of this conclusion, and in consideration of the possibility of the character being correlated with a difference of distribution or habitat, I think it should be nominally emphasized, and the two forms be known by distinct names until their identity has been fully established.

That the name *cephus* must be assigned to the red-tailed form is proved by the original diagnosis of Linnæus, which says:—"*caudæ medietas ultima ex ruffo flavescens . . . . cauda apice ferruginea.*"

The two may be contrasted as follows:—

a. The tail, at least in its distal portion, coppery red above and below; hairs on the ear white .... Subsp. *cephus*.
a'. Basal portion of tail the same colour as the sacrum above and greyish below, becoming gradually darker distally; a thick fringe of yellowish hairs on the ear.. Subsp. *cephodes*.

I regard as typical *C. cephus* some examples in the British Museum, two males and two females from the Benito River, Congo, and one female from Como River, Gaboon, collected by Mr. G. L. Bates. All are adult, and although taken practically at sea-level, they have remarkably long and thick coats. Two females, shot in June and July, are more richly coloured than one shot in December, and are perhaps a little longer in the coat. A male killed in October is long-coated and coloured like a female killed in June.

The Benito River specimens give the following measurements:—

♂.	Head and body	580 mm.,	tail	780 mm.
♀.	,, ,,	475 ,,	,,	670 ,,
♀.	,, ,,	490 ,,	,,	720 ,,
♀.	,, ,,	495 ,,	,,	690 ,,

The type of *C. c. cephodes* is the above-mentioned specimen, a subadult male, in the British Museum, ticketed "Gaboon (*Laglaize Coll.*, 80.6.7.3)." The total length of the head and body of the dried and twice made-up skin is 413 mm., and of the tail 575 mm. I have seen other examples of this subspecies living in the Gardens. One was brought by Mr. Hamlyn from the forest between Loango and the Gaboon. In addition to these there are two skins in the collection of the Society. One of these belonged to the animal that lived in the Gardens from August 1887 to January 1893. It must therefore have been at least about six years old. It differs from the type in being less yellowish red on the back, and in having the fore and hind limbs and tail much greyer. The second resembles the first, but is smaller and less vividly tinted. In both these menagerie-specimens the nose and interocular area are quite naked. In the type, on the contrary, the nose is covered with greyish pubescence. Similar pubescence, moreover, is observable in varying quantity upon the noses of the British Museum examples of *C. cephus cephus*. It has been stated by Pucheran (Rev. Mag. Zool. 1857, p. 195) and by Pousargues (Bull. Mus. Paris, iii. p. 52, 1897) that in the young of *C. cephus* the nose is covered with a diamond-shaped patch of hairs. This statement is not borne out by all the young examples that I have seen.

Cercopithecus erythrotis Waterh. (Plate XLI. fig. 5.)

Cercopithecus erythrotis Waterh. P. Z. S. 1838, p. 59, and 1841, p. 71 (and of subsequent authors).

The essential characters of this species are stated in the above-given key (p. 722).

Loc. W. Africa: Fernando Po and Cameroons.

Pousargues classified this species with his *Ascanius*-section of the Rhinosticti; but I think there is no doubt that its affinities lie with *C. cephus*, which that author excluded from the Rhinosticti.

Cercopithecus sclateri Poc.

Cercopithecus sclateri Poc. P. Z. S. 1904, pp. 433–436, fig. 87 (in text).

The characters of this species are described and its affinities discussed at length in the paper cited above.

Loc. W. Africa: Benin.

The Æthiops-group.

Cercopithecus Erxl. (*s. s.*) + *Chlorocebus* + *Cynocebus* Gray.

Face and ears black, very rarely pale and mottled with dark pigment, sometimes with white hairs on the lips. Head and upper side of body fairly uniformly speckled black and grey, yellow, or very rarely red. Outside of both fore and hind limbs also speckled and never darker, very generally lighter than the body. Tail mostly the same colour as the body, the end sometimes black or yellow. Whiskers, except in *C. nigroviridis*, directed upwards. Under side and inside of limbs pale.

Distr. From Sierra Leone to Abyssinia, thence southwards to Cape Colony.

Key to the Species.

a. Whiskers dusky olive, almost the same colour as the top of the head, though less yellow, directed backwards, with scarcely a trace of upward trend .... *nigroviridis.*

a'. Whiskers, at least on the lower half of the cheeks, white or yellowish, and quite differently coloured from the top of the head, with marked backward and upward trend.

b. No distinct white brow-band; yellow whiskers with a parting or whorl in front of the ear, half running up in front of that organ and half backwards beneath it, the ear being wholly exposed .... *sabæus.*

b'. A white brow-band; no parting in whiskers, the long hairs of which run backwards and upwards, so as to conceal the ears if long enough.

c. Tail shorter than body .... *djamdjamensis.*

c'. Tail longer than body.

d. Prevailing colour of dorsal surface chestnut-red, speckled black .... *matschiei.*

d'. Prevailing colour of dorsal surface yellowish, greenish, or grey, speckled black.

e. A considerable but varying quantity of silky-white hairs on the lips and chin; scrotum slate-blue.

f. Whiskers long and white, sharply defined in colour from the top of the head; a tuft of hairs at root of tail .... *æthiops.*

f'. Whiskers short and grizzled above, where they blend in colour with the top of the head; no tuft at root of tail .... *cynosurus.*

e'. Face sooty black, no silky-white hairs on lips or chin.

g. Whiskers rather sharply defined in colour from the top of the head; a tuft of hairs at the root of the tail on each side; no red at root of tail; scrotum slate-blue; hands and feet grey, end of tail yellow .... *tantalus.*

g'. Whiskers blending in colour with the top of the head; no tuft on each side of the root of the tail, which is red below; scrotum turquoise-green; hands, feet, and end of tail black or dusky in adult .... *pygerythrus.*

On account of the brevity of the descriptions of *C. matschiei* and *C. djamdjamensis*, I have been compelled to place them in the above-given key in such a manner that no clue to their true affinity is supplied. They are probably offshoots either of *C. æthiops* or *C. pygerythrus.* It would perhaps have better expressed the affinities of the last four species if *C. tantalus* and *C. æthiops* had been put under one heading, and *C. cynosurus* and *C. pygerythrus* under another.

CERCOPITHECUS SABÆUS Linn. (Plate XLII. fig. 1.)

Simia sabæa Linn. Syst. Nat. ed. 12, i. p. 38, 1766; Schreber, Säug. i. p. 100, pl. xviii., 1774; Audebert, Hist. Nat. Singes, fam. IV. sect. ii., 1799 (in part.; *nec* fig. iv.).

Cercopithecus sabæa Erxleben, Syst. Regni Anim. p. 33, 1777.

Le Callitriche, F. Cuvier, Hist. Nat. Mamm. i. pl. iv., 1819 (*Cercopithecus sabæus* in the Tabl. Gén. et Méthod. p. 1, 1824).

Cercopithecus sabæus Wagner, Martin, Matschie, and other authors.

Chlorocebus sabæus Gray, Cat. Monkeys Brit. Mus. p. 25, 1870.

Cercopithecus werneri Is. Geoffr. St. H., C.R. Acad. Sci. xxi. p. 874, 1850; id. Cat. Méthod. Mamm., Primates, p. 23, 1851; id. Arch. Mus. v. p. 539, pl. xxvii., 1851.

Cercopithecus callitrichus Is Geoffr. St. H., Cat. Méthod. Mamm., Primates, p. 23, 1851; and of Reichenbach, Sclater, Forbes, and most recent authors.

Face and lips black, scantily clothed with black hairs. No white brow-band except sometimes an indistinct one formed by the greyish basal portion of the hairs. Whisker-hairs yellow and strongly contrasted in colour with the hairs of the top of the head: their mode of growth characteristic; they run vertically upwards in front of the ear and horizontally backwards beneath it, so that the ear and a varying amount of the cheek in front of it are left uncovered. Colour of dorsal area of head and body greenish, resulting from the yellow and black annulation of the individual hairs, the varying width of the yellow annuli—of which there is frequently only one—causing a corresponding variation in the greenness of the pelage. Limbs greyer than the back; hands and feet grey, not black or brown. Tail darker than the back above, bright yellow at its distal end; the root of the tail beneath, the scrotal area in the male, and the pubic area in the female with intenser, sometimes almost rufous-yellow hairs. Throat, chest, and belly greyish or yellowish white. Scrotum slate-blue.

Loc. Senegambia, Sierra Leone, and Northern Liberia. Also introduced into some of the Cape Verde and West Indian Islands, and still abundant at least in Barbados.

This is one of the commonest Monkeys in European menageries.

Although of recent years this species has been universally cited as *C. callitrichus*, I can find no valid reason for setting aside the conclusion of earlier authors that *sabæus* is its earliest specific title. Even if it be established that Linnæus confused more than one species under that name, one of those species was certainly the Monkey that was subsequently described as *C. callitrichus*. Hence Schreber and Erxleben, who followed Linnæus, were acting within their rights in assigning the name *sabæus* to that species.

Even if *sabæus* be rejected, the well-known name *callitrichus* cannot, in my opinion, be retained, because it is antedated by *werneri*, which, judging from Geoffroy's figure and description of the type, was given to a redder form at most only subspecifically distinct from the type of *C. callitrichus*.

Cercopithecus æthiops Linn.

Subsp. æthiops Linn. (Plate XLII. fig. 2. Text-fig. 188.)

Simia æthiops Linn. Syst. Nat. ed. 10, i. p. 28, 1758; de Winton, in Anderson's Zool. Egypt, Mamm. p. 15, 1902.

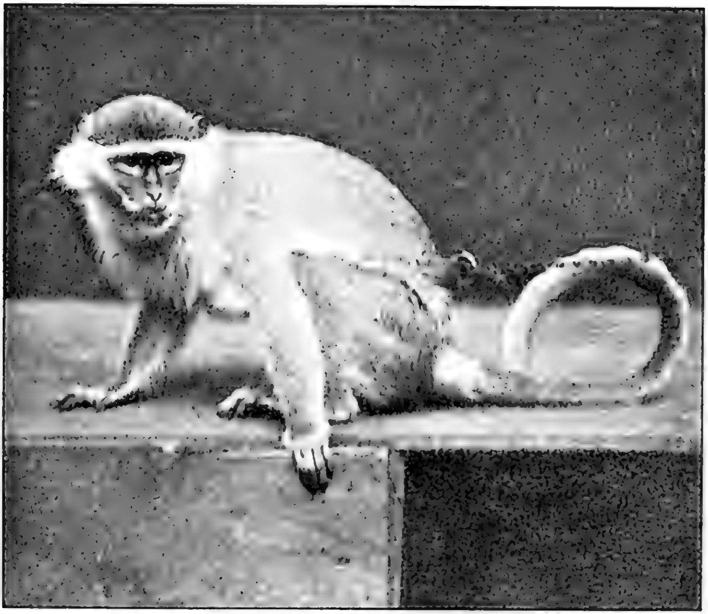
Cercopithecus griseo-viridis Desm. Mamm. p. 61, 1820.

Le Grivet, F. Cuvier, Hist. Nat. Mamm. i. pl. vii., 1819.

Simia subviridis F. Cuv. Dict. Sci. Nat. 1821, p. 17.

Cercopithecus griseus F. Cuv. Hist. Nat. Mamm., Tabl. Gén. et Méthod. p. 1, 1824.

Text-fig. 188.



Cercopithecus æthiops æthiops Linn.

(From a young specimen from Khartoum living in the Society's Gardens.)

Cercopithecus sabæus Is. Geoffr. St. H., C.R. Acad. Sci. xxi. p. 874, 1850; id. Cat. Méthod. Mamm., Primates, p. 22, 1851 (*nec* Linn.).

Face black with some short silvery-white hairs invading the upper and lower lips from the cheeks and chin. Whisker-hairs on cheeks wholly white, very long, growing upwards and backwards over the ears. A distinct white brow-band passing laterally into the white of the cheeks. The top of the head and the cheeks strongly contrasted from each other in colour. The head, neck, upper parts of the body, and outside of the limbs speckled greyish yellow and black, the general effect of the combination of speckling being greyish green; the outside of the limbs greyer than the body and head; the hands and feet also grey or becoming gradually and lightly infuscate. Tail greyish speckled above, white beneath throughout, sometimes (? always when the tail is complete) with longer white hairs at the end; at the base on each side a tuft of white hairs and white beneath at the root. The whole of the under side of the body and the inside of the limbs white; no red or yellow hairs on the pubic or anal areas.

Loc. Upper Nile: Abyssinia, Senaar, Kordofan.

During recent years the name *æthiops* Linn. has by almost common consent been applied to one of the species of *Cercocebus*. I can find no reason, however, for doubting the correctness of Mr. de Winton's verdict that it was given in the first instance to the species of *Cercopithecus* of the Upper Nile which is usually cited as *sabæus* or *griseo-viridis*.

At the present time there are living in the Gardens three subadult examples that I regard as typical *C. æthiops*, one from Khartoum and two from the White Nile. Apparently referable to the same form are three examples in the British Museum, namely, one from Senaar (*Parreyes coll.*, 46.6.15.53), one from Renk in the Sudan (*R. M. Hawker*, 1.8.8.1), and one from Metola Shoa, 11,000 ft. alt. (*W. N. Macmillan*, 6.11.1.3). In the last the head and body measure 510 mm. and the tail 600 mm. I do not know whether examples of the typical subspecies ever have any red colouring in the hair at the base of the tail below.

Subsp. ELLENBECKI Neumann.

Cercopithecus ellenbecki Neumann, SB. Ges. nat. Fr. Berlin, no. 3, p. 50, 1902.

Intermediate between *C. æ. hilgerti* and *C. æ. æthiops* from the White Nile. Most like the latter, but the upper side deeper olive-yellow. Feet and hands somewhat darker. Under side of tail clear grey, only the extreme tip white.

Loc. Zuai Lake (Suksuk and Maki Rivers).

Two examples in the British Museum perhaps belong to this local race. One is a specimen identified by Gray * as *C. engythittia* Herm., and the other belonged to the East India Company and is labelled "Ashkowa (44.9.30.15)." Both are much greener in colour than those mentioned above, which came from Renk and Senaar. It is possible also that the two specimens in the

* *Chlorocebus engythittia* Hermann, Gray, Cat. Monkeys Brit. Mus. p. 26, 1870.

collection of the Society, mentioned below under the name *C. æthiops hilgerti*, should be referred here.

Subsp. HILGERTI Neumann.

Cercopithecus hilgerti Neumann, SB. Ges. nat. Fr. Berlin, no. 3, p. 50, 1902.

Reddish olive. Fore limb grey; hind limb grey from knee; hands and feet blackish, but the black not sharply defined from the grey. Tail blackish grey mixed with olive above, grey beneath, with white tip. Whisker-hairs long, white; face black with narrow frontal band. Upper side of head mixed with black; a rusty-red spot at base of tail below. White below and on inner side of arms.

Loc. Webbi Schebeli (Gallaland).

In the young there is no rusty spot at root of tail and the feet and hands are grey.

In the collection of the Society there is the skin of an adult male specimen ticketed "N.E. Africa, 17.6.71 to 14.10.75," which in most points agrees very well with the description of *C. hilgerti*, except that the upper side is thickly speckled black and yellow without any tinge of red. As in typical *C. æthiops*, there is a conspicuous white tuft at the root of the tail on each side and the upper and lower lips are clothed with many short white hairs, features which are not mentioned by Neumann; and a young example now living in the Gardens, received from Mrs. W. N. MacMillan from Southern Abyssinia, belongs apparently to the same subspecies. There is no red at the root of the tail, however. This may perhaps be due to the immaturity of the specimen.

CERCOPITHECUS MATSCHIEI Neumann.

Cercopithecus matschiei Neumann, P. Z. S. 1902, ii. p. 143; id. SB. Ges. nat. Fr. Berlin, no. 3, p. 51, 1902.

Colour chestnut-red, mixed with black. Limbs pale olive-yellow, grey beneath; hands and feet blackish. Tail olive-yellow mixed with black, pale beneath, with greyish-white tip. Whisker-hairs long and white. Under side white; a rusty-red spot on the base of the tail.

Loc. Omo and Sobat Rivers.

This form would be regarded by myself, I suspect, as a subspecies of *C. æthiops*. It certainly differs, however, from that species, as well as from all the species of the group known to me, in its chestnut-red coloration.

CERCOPITHECUS DJAMDJAMENSIS Neumann.

Cercopithecus djamdjamensis Neumann, P. Z. S. 1902, ii. p. 143; id. SB. Ges. nat. Fr. Berlin, no. 3, p. 51, 1902.

Colour as in *C. matschiei*, but paler and yellower red; hind leg from the knee ash-grey. Under side silver-grey. Tail blackish grey, tinged with olive above at the base, black distally; paler beneath. Whisker-hairs short. Coat thick, forming a kind of mane on the shoulders and fringes on the belly and hind legs. Tail extremely short, much shorter than the head and body (55 : 90).

Loc. Mountains east of Abaje Lake (10,000–12,000 ft.).

This mountain form differs, as Neumann points out, from all other species of *Cercopithecus* of this group in the extreme shortness of the tail. Unfortunately the description of other characters is too brief to supply information as to the affinities of the species.

CERCOPITHECUS TANTALUS Ogilby.

Subsp. TANTALUS Ogilby. (Text-fig. 189, p. 732.)

Cercopithecus tantalus Ogilby, P. Z. S. 1841, p. 33; Matschie, SB. Ges. nat. Fr. Berlin, 1893, p. 216.

? *Cercopithecus chrysurus* Blyth, J. A. S. Bengal, xiii. p. 477, 1844.

? *Cercopithecus sabæus* Reichenbach, Affen, p. 114, 1863 (in part.).

? *Cercopithecus callitrichus* Forbes, in Allen's Nat. Libr., Monkeys, ii. p. 62, 1894 (at least in part).

? *Cercopithecus sabæus* Pousargues, Ann. Sci. Nat. (8) iii. p. 224, 1896.

Face as black as in *C. sabæus* and *C. pygerythrus*; no white hairs on upper lip and chin. Whiskers long, growing upwards and backwards and concealing or partially concealing the ears, the summit of the whiskers yellow, the ends of the uppermost hairs lightly infuscated and speckled. A distinct white brow-band, marked off from the whiskers laterally both by colour and by a narrow black streak extending backwards behind the corner of the eye. Whiskers sharply defined by their colour from the top of the head. Colour of head, dorsal surface, and of limbs very much the same as in *C. cynosurus*. Tail longer than head and body, becoming paler at its posterior end, where in the adult it is as yellow as in *C. sabæus*; a tuft of usually white hairs on each side at its base; no red hairs beneath at the base. Hairs round the callosities also white; but beneath them in adult and immature examples of both sexes there is a patch of orange or rusty-yellow hairs. Scrotum in male slate-blue; prepuce scarlet.

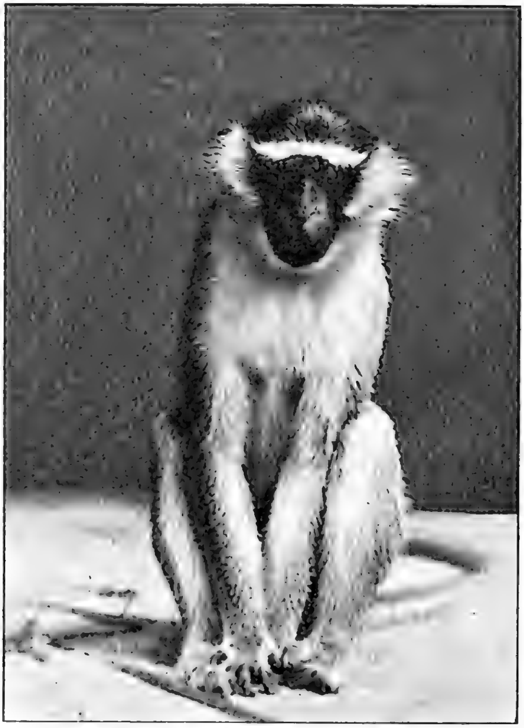
♂. Head and body 500 mm., tail (imperfect) 750 mm.

Loc. Nigeria (Lakoja, Dahomey, Upper Benué River) up to Lake Chad.

A large number of specimens of this species have been exhibited in the Society's Gardens. For most of these, as for Ogilby's unknown type, no locality was recorded. Recently, however, specimens have been sent to the Society from the above-mentioned places.

Although *C. tantalus* has never, I believe, been previously identified with certainty, I do not think there is any reason to doubt the correctness of my determination. At all events the description of *C. tantalus* applies more closely to the form to which I have given the name than to any other known to me;

Text-fig. 189.



Cercopithecus tantalus tantalus Ogilby.

(From a specimen living in the Society's Gardens.)

and I find it impossible to believe that so common a Monkey in menageries has escaped naming down to the present time. For many years there has been a stuffed example in the British Museum labelled "*C. callitrichus*"; and it was probably this specimen that caused Dr. Forbes to describe *C. callitrichus* (= *sabæus*) as having a white brow-band. *C. tantalus*, as here identified, may be at once distinguished from *C. sabæus* by the direction of growth of the whiskers as well as by the frontal band. The tuft at the root of the tail and the sharp differentiation in colour of the whiskers from the crown of the head point to affinity with *C. æthiops*; but the absence of white hairs on the lips, the yellower whiskers, the yellow end of the tail, and the rusty pubic patch separate *C. tantalus* from that species. The alleged blackness of the face and the presence of orange-yellow hairs round the scrotum in the examples, identified as *C. sabæus* by Pousargues, from the Grande Brousse and the Kemo Rivers in the French Congo, suggest the possibility of these Monkeys belonging to *C. tantalus* rather than to *C. sabæus*. And I think there cannot be much doubt that certain Nigerian Monkeys referred to *C. sabæus* by Audebert and Reichenbach belonged to this species.

In the British Museum there is a specimen of this species ticketed Jebba (*G. F. Abadie*, 0.2.18.1), resembling that described above in almost every respect, except that it may be regarded as aged or decolorised. There is scarcely any trace of yellow in the whiskers, and the hairs of the dorsal area of the head and body are almost brownish yellow without the rich colouring characteristic of those in the Society's collection. I am disposed to attribute this difference to the fact that menagerie-kept examples are protected from those influences of weather to which wild animals are subjected. I have noticed similar differences between menagerie and wild-caught specimens of other species of this genus. It is, in my opinion, not improbable that *C. æthiops* and *C. tantalus*, as here recognised, will be found to intergrade. Up to the present time, however, I have not seen any specimen that could not with certainty be assigned either to one or the other of these forms.

Subsp. BUDGETTI, nov.

Differing from the typical Nigerian form in having the long whisker-hairs much more decidedly speckled and annulated, some black hairs on the hands and feet near the base of the fingers and toes, and the hairs below the knee and elbow on the inner side of the limbs distinctly speckled. There is a very large patch of almost fiery-red hairs on the pubic area.

Loc. Uganda: Bathyaba, on the east shore of Lake Albert (*J. S. Budgett*, no. 3.2.12.1 in B.M.).

The extension of *C. tantalus* into Western Uganda is a fact of some interest. *C. tantalus budgetti* differs from *C. pygerythrus centralis* Neum., its most nearly related geographical ally, in the pale colour of the hands, feet, and extremity of the tail, its darker, less green dorsal colouring, its dirtier yellow and longer whiskers, the presence of a black streak behind the corner of the orbit, limiting the brow-band, the speckling of the under side of the limbs distally, and in the size and brilliance of the rufous patch of pubic hairs.

CERCOPITHECUS CYNOSURUS Scop. (Plate XLII. fig. 3. Text-fig. 190.)

Simia cynosurus Scopoli, Delic. Flor. Faun. Insubr. i. p. 44, pl. xix., 1786.

Le Malbrouck, F. Cuvier, Hist. Nat. Mamm. i. pl. ii., 1819 (named *C. cynosurus* on p. 1 of Tabl. Gén. et Méthod., 1824).

Cercopithecus cynosurus Desmarest, Mamm. p. 60, 1820, and apparently of most subsequent authors.

Cercopithecus tephrops Bennett, P. Z. S. 1833, p. 109.

Face usually, at all events, much less heavily pigmented than in other species of the group, being pallid, greyish, and to a

Text-fig. 190.

Cercopithecus cynosurus Scop.

(From a specimen living in the Society's Gardens.)

varying degree patched or clouded with black, darker on the nose than laterally, and with many short white hairs on the upper and lower lips and chin. Whiskers short, growing upwards but not concealing the ears, speckled down to the level of the edge of the ear, and much the same tint as the top of the head, those on the lower half of the cheek white. A white brow-band; but neither the brow-band nor the top of the head sharply differentiated from the cheeks in colour. The head and body uniformly speckled yellow and black, the tint of the yellow sometimes rich, sometimes dull and greyish. Limbs externally below the shoulder and hip becoming gradually greyer; upper surface of hands, fingers, feet, and toes grey. Tail longer than head and body; scarcely yellow, even at the base, speckled grey and black, the black predominating; no lateral tuft of hair at its base, and no red hair at its base beneath; grey throughout on the under side. Under side and inside of limbs greyish white, the middle line of the belly sometimes tinged with yellow; hairs round scrotum in male and on pubic area in female yellowish grey. No coloured hair round the callosities, which are pink. Scrotum in male slate-blue, as in *C. æthiops* and *C. tantalus.*

Loc. W. Africa: south of the Congo, Brazzaville (*Pousargues*).

Numerous examples of this species have from time to time been exhibited in the Society's Gardens, but in no case has the exact locality been known. The above-given description has been taken from the skins of an adult male and female. Pousargues says the hair round the scrotum and vulva is of the same colour as that of the belly. This, however, is not the case in the skins of two males and two females that I have examined. He also says that the hairs on the face are black. This also is not so in those that I have seen. It can hardly be claimed as definitely established that the species here described as *C. cynosurus* is the same as the one to which Scopoli gave that name. Tradition, however, seems to have fixed the name *cynosurus* on to the present species, and there appear to be no valid reasons for setting aside the identification.

CERCOPITHECUS PYGERYTHRUS Cuvier.

Subsp. PYGERYTHRUS Cuv. (Plate XLII. fig. 4. Text-fig. 191, p. 736.)

Cercopithecus pygerythra F. Cuv. Hist. Nat. Mamm. iii. pl. 24, 1821.

Cercopithecus pygerithræus Desmarest, Mamm. pt. 2, Suppl. p. 534, 1822.

Cercopithecus pygerythrus Lesson, Is. Geoffr. St. H., and of subsequent authors.

Simia erythropyga Cuvier, Règn. Anim. nouv. ed. p. 92, 1829; Fischer, Syn. Mamm., Addenda, p. 336, 1830.

Cercopithecus pusillus Desmoulins, Dict. Class. vii. p. 568, 1825.

Cercopithecus lalandii Is. Geoffr. St. H. Dict. d'Hist. Nat. iii. p. 305, 1843.

Face black, clothed with black hairs; a very distinct white brow-band continuous laterally with the white hair clothing the anterior portion of the cheeks, so that the face usually appears to be encircled with a continuous ring of white. Whiskers long, more or less concealing the ears, the ends of the hairs greyish and speckled with black, so that there is no sharp line of demarcation in colour between the whiskers and the top of the head. Head, neck, body, and outer surface of arms and legs greyish, speckled uniformly black and washed-out yellow, sometimes with a pale wash of yellow, the limbs greyer than the body; the hands and the feet in the adult black, blackish, or at all events darker grey than the arms and legs, the hands darker than the feet. Hairs on the back of the thighs up to the callosities whitish, those round scrotum in male and on pubic area in female white (perhaps not

Text-fig. 191.

Cercopithecus pygerythrus Cuvier.

(From a specimen living in the Society's Gardens.)

always true, at all events of the female). Tail coloured like the back, but greyer, its distal end black, a very conspicuous patch of rusty-brown red at its base beneath and above the callosities. Scrotum turquoise-blue; prepuce scarlet.

Loc. S. Africa.

The types of *C. pygerythrus*, *C. pusillus*, and *C. lalandii* were recorded from the Cape. Hence these names may be regarded as synonyms. The British Museum has a series of these Monkeys belonging to the Rudd Collection, and shot by Mr. Claud Grant:—

♀.	Head and body	403 mm.,	tail	614 mm.	Umfolosi, Zululand.
♂.	" "	309 "	"	457 "	" "
♂.	" "	462 "	"	— "	" "
	" "	430 "	"	598 "	" "
	" "	453 "	"	592 "	Legogot, Barberton.
♂.	" "	465 "	"	699 "	Hlavisa, Zululand.
	" "	446 "	"	559 "	Knysna, C. Colony.
	" "	480 "	"	471* "	" "

The above-given measurements were taken in the flesh.

Cercopithecus pygerythrus with its subspecies, as here recognised, ranges from Uganda to Cape Colony. Broadly speaking, East-African examples differ from South-African examples in being yellower in colour and in the marked evanescence of the black speckles from the hair on the sides of the body, which are thus more uniformly tinted yellow, sometimes with a tinge of red. South-African examples are, as a rule at all events, more uniformly speckled all over and much greyer in colour. I have selected for description as subspecies some examples in the British Museum which seem to represent distinguishable local races.

Subsp. RUFOVIRIDIS Is. Geoffr.

Cercopithecus rufoviridis Is. Geoffr. St. H., C.R. Acad. Sci. xv. p. 1038, 1842; id. Dict. d'Hist. Nat. iii. p. 307, 1843; id. Arch. Mus. ii., 1843.

Cercopithecus flavidus Peters, Reise Mossamb., Säug., p. 265, pl. i. *b*, 1852; Matschie, SB. Ges. nat. Fr. Berlin, 1893, p. 213.

To this subspecies I refer a young male specimen in the British Museum from Angoniland, Brit. Centr. Africa (*Sir A. Sharpe*, 0.11.19.1). The coat is long and yellowish green, speckled with black on the head and dorsal area of the body. The sides of the body are strongly tinged with pale rusty red, a tint which is strongly in evidence when the hair is parted to show the under-fur. The whiskers are short, greyish ticked with black. The end of the tail is black, but the hands and the feet are scarcely darker than the rest of the limbs. This is possibly due to the immaturity of the specimen. The hairs round the scrotum are red.

The red tinge of the hairs on the sides of the body and round the scrotum distinguish this form from the typical S.-African *C. p. pygerythrus*.

The exact locality of the type of *C. rufoviridis* was unknown, but since Matschie declares that this Monkey was redescribed as *C. flavidus* by Peters, I regard the Mozambique form as typical of *C. p. rufoviridis*.

* Query error for 571?

Subsp. WHYTEI.

Upperside greenish ticked with black, very much the same colour as in *C. pygerythrus centralis*, but differing from that form in the colour of the under-fur, which, instead of being sooty, is of a pinkish grey, in the greater length of the coat, especially over the shoulders, and in the length and colour of the whiskers, which are long, completely concealing the ears, and very conspicuously banded.

Loc. Mt. Chiradgula, Nyasaland (*A. Whyte*, 95.12.7.7).

A single specimen in the British Museum.

Subsp. JOHNSTONI, nov.

Face jet-black; a distinct greyish-white or tawny-white brow-band, broadly continuous at the sides with the paler hair on the cheek, which it resembles in colour. Long cheek-hairs in front of and overlying the ears banded and gradually passing in tint dorsally into those of the upper side of the head. Coat long; general colour of the dorsal surface a washed-out tawny grey, not so distinctly speckled as in most other forms, and without any marked greenish-yellow tint, the predominance of the tawny hue and indistinctness of the speckled appearance being due to the relatively great length of the distal pale band on the individual hairs, which on the fore part of the body considerably exceeds that of the black areas adjacent to it (in a hair of 60 mm. in length, taken from the shoulders, this band measures 13, the proximal black area being 10, and the terminal 8). On the posterior portion of the body the areas are more equal in length, but laterally where the dark speckling dies away the predominance of the pale bands is still more marked. Arms greyer than body; hands and wrists black above and rather sharply defined from the forearm. Legs also greyer than body, thighs sometimes washed with yellow; feet blackish, but not so black as hands. Under side dirty white. Tail greyish above, scarcely washed with yellow, becoming quite black at the tip, under side with a large rusty-red basal patch, the rest greyish or greyish rufous to the tip. Some greyish-rufous hairs on the pubic area.

Measurements of dried skin:—Head and body about 430 mm., tail about 600.

Loc. Moshi: south side of Kilima Njaro, 5000 ft. alt. (*Sir H. H. Johnston*).

Two specimens in British Museum. Reg. nos. 85.1.17.1 and 85.1.17.2 (*type*). There is also a young female specimen in the collection of the Society which was received 17.9.91, and died in the Gardens 24.11.92. This specimen, ticketed "Kilima Njaro," is much richer and more yellowish green in colour than those collected by Sir H. H. Johnston, which is possibly due to want of exposure to rain and sun. The coat, however, is thick and long, and the hairs show the same predominance of the pale band. There is also an example in the British Museum labelled Fort Hill, Mt. Kenia (*S. L. Hinde*, Reg. no. 2.7.6.1), representing the same or a closely allied form.

Subsp. CENTRALIS Neumann.

Cercopithecus centralis Neumann, Zool. Jahrb. Syst. xiii. p. 533, 1900.

General colour fairly uniformly greenish, speckled with black. Whisker-hairs short, not concealing ears, the ends of the long hairs indistinctly banded. Tail grey, yellowish at root above; black at end. The rusty-red hair on the root of the tail and above the callosities small in quantity (perhaps owing to immaturity of specimens). Forearm below elbow and hind leg below knee ashy grey, speckled; wrist and hand black; ankle grey, foot blackish. Under-fur sooty grey on back, pale grey at sides. In the male the hairs round the scrotum, and in the female those on the pubic area, are tinged with red as in *C. tantalus* (this would probably increase in quantity with age).

♂. Head and body 530 mm., tail 445 mm.
♀. ,, ,, 614 ,, ,, 525 ,,

Loc. Dakota and Ssesse Island (*Neumann*).

The above-given description is taken from two examples in the British Museum, from Barumba, in Ankole, 5000 ft., collected by the late Mr. W. Doggett. Mr. Thomas tells me they were identified by Dr. Neumann, whose original description of this Monkey is too brief to be of any value.

In the British Museum there is the skin of a specimen from the Juba River, S. Somaliland, which only differs in minor points from the specimens above referred to *C. p. centralis*. Neumann also records, but refrains from naming, examples also from the Juba River, setting them aside as allied to *C. rufoviridis*.

CERCOPITHECUS NIGROVIRIDIS, sp. n. (Plate XLII. fig. 5.)

Skin of face black, pale on the cheek; hairs on upper lip and adjacent to face black. A very narrow black superciliary band, also a narrow black stripe continued laterally from the corner of the eye towards the ear. Hairs on cheeks directed straight backwards, blackish grey near the face, and with an obscure golden subapical band towards the ear, where they are of much the same tint as those on the summit of the head. Hair on summit of head, neck, back, shoulders, and sides of body black with two narrow rich golden-yellow bands, which are much narrower than the black area between them or than the apical area. Hence the black is the dominant colour. Frequently, however, the proximal of the two yellow bands is not, or scarcely, differentiated from the greyish-brown colour of the basal portion of the hair. Arms externally much like the back, but the yellow is paler and less rich; hands blackish above. Legs externally yellower than the back, owing to the greater width of the yellow band; foot and ankle less yellow than thigh. Chin, throat, sides of neck, chest, belly, and inside of limbs greyish or yellowish white. On a level with the shoulders the dark hairs encroach on each side across the chest, partially separating the pale hue of the throat from that of the chest and belly. Tail almost the same colour as the back above, but darker, especially distally; yellower on the under side, quite yellow at base. Pubic area below the callosities rusty red.

Length of body and head 290 mm., tail defective.

Loc. Upper Congo.

The type of this species is the skin of a female specimen that lived in the Society's Gardens from Nov. 29th, 1892 to May 15th, 1894. It is ticketed "Congo." Subsequently, however, there was a specimen living in the Gardens, belonging to the Hon. Walter Rothschild, which was brought by Mr. J. D. Hamlyn from Brazzaville (Stanley Pool), 700 miles up the Congo, in Belgian territory. Mr. Hamlyn tells me it was brought with other Monkeys to Brazzaville from further inland. Hence we are still ignorant of the exact locality of the species.

This species, which has remarkably soft and silky hair, is about the size of *C. talapoin*. In this particular, as well as in the colour of the cheek-hairs, it differs from the rest of the Æthiops-group. The direction of the hair on the cheeks at once differentiates it from *C. talapoin*.

The TALAPOIN-group.

Miopithecus Is. Geoffr. St. H.

In addition to the characters for this group mentioned in the analytical key (p. 681), it may be mentioned that the single known species is the smallest of the members of this group of Monkeys. It is frequently the case in Mammalia that a species composed of small individuals presents characters which are met with in the young of allied species composed of larger individuals. The adult *Hippopotamus liberiensis*, for example, resembles in many features the young of its larger ally *H. amphibius*. So, too, with *C. talapoin*. The small face and large cranium of the adult recall those of the young of other species of this genus, so much so that any one acquainted with the aspect of full-grown specimens of other species would suppose upon a cursory examination that an adult *C. talapoin* was an immature animal.

CERCOPITHECUS TALAPOIN Schreber.

Subsp. TALAPOIN Schreb. (Plate XLII. fig. 6.)

Simia talapoin Schreber, Säug. i. pl. xvii., 1774.

Cercopithecus talapoin Erxl. Syst. Regni Anim. p. 36, 1777; and of recent authors.

Miopithecus talapoin Is. Geoffr. St. H., C.R. Acad. Sci. xv. p. 720, 1842; id. Dict. Hist. Nat. iii. p. 309, 1845.

Simia melarhina F. Cuv. Règn. Anim. nouv. ed. p. 92, 1829.

Skin of face pallid; nose, upper and lower lips clothed with black hair; no superciliary pale band on head. Hairs on cheeks mostly golden yellow, many of them apically infuscate; a black streak running backwards from the corner of the eye halfway towards the ear; the hairs on the anterior half of the area between the eye and ear directed backwards, those on the posterior half radiating from a point near the middle of the ear upwards, forwards, and downwards, forming a well-defined semicircular tract. Hair on lower portion of cheek longish, and directed straight backwards. Ears flesh-coloured or black, with some blackish hairs or black and yellow hairs on them. Summit of head, nape of neck, and back uniform dark olive-yellow, the hairs greyish on the basal two-thirds, black distally and marked with one golden-yellow band, which is narrower than the black terminal portion: hence black preponderates on these areas. On the shoulder and hips the yellow begins to increase in extent at the expense of the black. This is still more emphasized on the arms and legs, which are externally golden yellow; hands and feet also golden yellow above. Chin, throat, chest, belly, and inside of limbs greyish white, the limbs becoming yellower distally. Tail with its dorsal surface the same colour as the back, becoming blacker distally; lower surface golden yellow at base, then greyer, and becoming blackish distally. Hairs round anus and on pubic and scrotal regions and back of thighs golden yellow.

Measurements:—

♀. Head and body 340 mm., tail 380 mm.
♂. " " 350 " " 375 "

Loc. Cameroons and Congo.

The above-given description is taken from two specimens in the British Museum collected by Mr. G. L. Bates. The male was taken 30 miles from the mouth of the Benito River, at an altitude of 200-300 feet; the female from the Como River, 70 miles from the Gaboon, where it was caught in a swamp almost on the sea-level.

The female is decidedly less richly coloured than the male.

Subsp. ANSORGEI, nov.

Larger than the form from the Benito River which I select as typical for the species, and further differing in having much less black upon the cheeks, the forwardly directed hairs in front of the ear for the most part white instead of yellow and black, and the hairs on the cheek adjacent to the face yellow with slightly darkened tips, instead of yellow with pronounced infuscation of the distal end. The whole dorsal area paler and greener, owing to the fact that the yellow area on the hairs is much longer, practically equalling, in fact, the black terminal portion, instead of being only about half its length as in *C. talapoin talapoin*. The ventral area a clean instead of a dirty white.

Head and body ? (wrongly labelled 900 mm., which is probably a misprint for 400), tail 525 mm.

Loc. Cambaca, in Angola (*Dr. W. J. Ansorge*, no. 4.4.9.1 in B.M. register).

A single typical specimen.

I do not know whether the species described by Geoffroy as *Miopithecus capillatus* (C.R. Acad. Sci. xv. p. 720, 1842; Dict. Hist. Nat. iii. p. 309, 1845) is related to *C. talapoin* or not. The description indicates a distinct species at all events. The locality was unknown.

THE PATAS-GROUP.

Erythrocebus Trouess.

Large Monkeys, differing from the members of the foregoing groups in standing high upon their long slender limbs, in the pallid whitish hue of the skin of the face and ears, and in the preponderance of red in the hairs of the body and head and of white on the lower limbs.

Distr. Sierra Leone to the Upper Nile.

CERCOPITHECUS PATAS Schreber.

Subsp. PATAS Schreb. (Plate XLI. fig. 6. Text-fig. 192, p. 743.)

Simia patas Schreber, Säug. i. p. 98, pl. xvi., 1774.

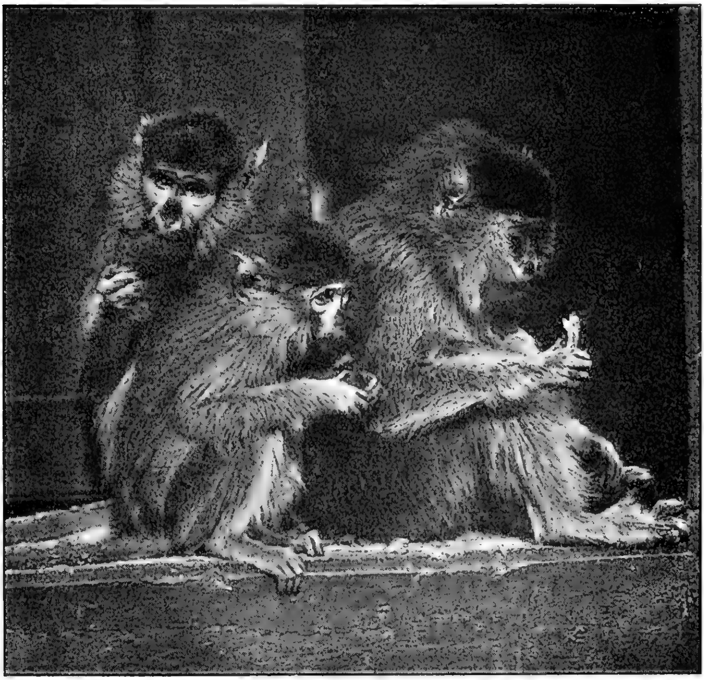
Cercopithecus patas Erxl. Syst. Regni Anim. p. 34, 1777, and of most recent authors.

Simia rubra Gmelin, Syst. Nat. i. p. 34, 1788.

Cercopithecus ruber Geoffr. Ann. Mus. xix. p. 96, 1812, and of many authors.

Hair on nose black and extending upwards to join the black superciliary band, which generally has a few white hairs and which extends laterally to the ears with a slight dorsal angulation above the temple; hairs on lips and chin white in adult. Whiskers directed downwards and backwards; black close to the face, mostly greyish white, but becoming gradually yellower and annulated with black beneath the ear. Hair on summit of head short and rich coppery or orange-red in front, becoming speckled posteriorly, the coppery-red patch gradually blending with the hair of the rest of the head. On the occiput, nape, shoulders, and anterior portion of the back the hairs are red to the base, with the tip black and a pale yellowish subapical annulus. On the lumbar and sacral regions and above the root of the tail and on the upper portion of the thighs the hairs are uniformly red. On the shoulders the hairs

Text-fig. 192.



Cercopithecus patas patas Schreber.

(From specimens living in the Society's Gardens.)

are long and blackish, with a broad pale subapical annulus, giving an iron-grey appearance to this area. On the sides of the neck the hairs are washed with yellow; on the sides of the body they are longer than on the back and redder. Tail dark rich red above, greyish or yellowish below, and paler apically. Chin, chest, belly, inner side of limbs and outer side up to shoulders, and ischial callosities white or greyish white.

Young. In young examples referred by me to this species the hairs clothing the upper and lower lips are black and not white as in the adult; and the outer sides of the legs and arms are pale yellowish red. I have very strong reasons for suspecting, although no actual proof of the fact is supplied by observation of the process in an individual, that the hairs of the lips turn from black to white and those of the appendages from yellowish to white during growth.

Text-fig. 193.

Cercopithecus patas pyrrhonotus Hempr. & Ehrenb.

(From a specimen from Uganda in the Society's Gardens.)

Subsp. PYRRHONOTUS Hempr. & Ehrenb. (Text-fig. 193.)

I also suspect that the nose of the white-nosed eastern form of this species, for which the oldest name appears to be *pyrrhonotus*, is black in the young. The Society possesses skins that I refer to this form, at all events provisionally, from Uganda (*C. R. Hall*) and Gondokoro (*Col. Bruce*). They may be distinguished from the West-African specimens I have seen by the following characters:—

a. Nose black in adult, some black hairs adjacent to the face on the cheeks; red patch on the crown of the head not very sharply defined; shoulders iron-grey .... Subsp. *patas*.
a'. Nose white in the adult; hairs on cheeks adjacent to face also white; red patch on crown of head sharply differentiated and bordered antero-laterally by a short black band extending upwards from the superciliary band above the external angle of the eye; shoulders less noticeably iron-grey .... Subsp. *pyrrhonotus*.

Although the Society almost always has examples of this species on exhibition, and there are a number of skins of old and young individuals in the collection, they are mostly labelled merely W. Africa. The British Museum possesses practically no material. Hence lack of properly localised skins makes it impossible for me to contribute anything to our knowledge of the geographical races of the species.

Broadly speaking, *C. patas* with its subspecies is distributed from Senegambia across N. Africa to the Upper Nile. It is, I believe, an open country and not a forest form.

For further information regarding this species and its local forms, reference may be made to the recent paper by Dr. Matschie which is cited in the appended list of names:—

patas (=*ruber*). References as above. Senegal.
rufa Schreber, Säug. Suppl. pl. xvi. B, 1801. Loc.?
circumcinctus Reichenbach, Affen, p. 123, 1863. Loc.? Probably W. Africa.
sannio Thomas, Ann. Mag. Nat. Hist. (7) xvii. p. 173, Feb. 1906. Go, Lake Chad.
zechi Matschie, SB. Ges. nat. Fr. Berlin, 1905, pt. 10, p. 274. Togoland.
kerstingi, id. loc. cit. Sokode and Fasan (Nigeria).
langheldi, id. op. cit. p. 275. Upper Benue, Cameroons.
pyrrhonotus Hempr. & Ehrenb. Verh. Ges. nat. Fr. Berlin, i. p. 407, 1829; iid. Symb. Phys. pl. x. Le Nisnas, F. Cuv. Hist. Nat. Mamm. i. pl. 27, 1830. Kordofan.
poliophæus Reich. Affen, p. 122, 1863 (=*poliolophus* Heuglin, Reise Nord-Afr. ii. p. 5, 1877). Fazoglo, Darfur.
baumstarki Matschie, op. cit. p. 273. Ikoma.

Dr. Matschie regards all these forms, with exception of *C. p. sannio*, as species of the genus *Erythrocebus*.

EXPLANATION OF THE PLATES.

Plate XXXIX.

Fig. 1. Head of *Cercopithecus leucampyx nigrigenis*, subsp. nov. (p. 692). From the skin of type specimen.
2. Head of *C. leucampyx stuhlmanni* Matschie (p. 690). From the type specimen of *C. otoleucus* Scl., now living in the Society's Gardens.
3. Head of *C. kolbi hindei*, subsp. nov. (p. 703.) From the skin of the type specimen.
4. Head of specimen identified as *C. albogularis albotorquatus* Pous. (p. 702) in the collection of the Society.
5. Head of *C. martini* Waterh. (p. 698). From a skin in the collection of the Society.

Plate XL.

Fig. 1. Head of *C. campbelli* Waterh. (p. 710). From a skin in the collection of the Society.
2. Head of *C. burnetti* Gray (p. 710). Ditto.
3. Head of *C. signatus* Jent. (p. 721). Ditto.
4. Head of *C. ascanius schmidti* Matschie (p. 720). From a skin, not quite typical, in the collection of the Society.
5. Head of *C. ascanius ascanius* Audeb. (p. 719). From a skin in the collection of the Society.
6. Head of *C. petaurista buttikoferi* Jent. (p. 718). Ditto.

Plate XLI.

Fig. 1. Head of *C. diana* Linn. (p. 682). From a skin in the Society's collection.
2. Head of *C. l'hoesti* Scl. (p. 714). From the type specimen ditto.
3. Head of *C. cephus cephus* Linn. (p. 722). From a specimen now living in the Society's Gardens.
4. Head of *C. erythrogaster* Gray (p. 715). Ditto.
5. Head of *C. erythrotis* Waterh. (p. 725). From a skin in the Society's collection.
6. Head of *C. patas patas* Schreber (p. 742). Ditto.

Plate XLII.

Fig. 1. Head of *C. sabæus* Linn. (p. 726). From specimen living in the Society's Gardens.
2. Head of *C. æthiops æthiops* Linn. (p. 728). Ditto.
3. Head of *C. cynosurus* Scop. (p. 734). Ditto.
4. Head of *C. pygerythrus pygerythrus* Cuv. (p. 735). Ditto.
5. Head of *C. nigroviridis*, sp. n. (p. 739). From the skin of the type specimen.
6. Head of *C. talapoin talapoin* Schreber (p. 741). From specimens now living in the Society's Gardens.

No. 45.

ABSTRACT OF THE PROCEEDINGS

OF THE

ZOOLOGICAL SOCIETY OF LONDON.*

May 7th, 1907.

G. A. BOULENGER, Esq., F.R.S., Vice-President, in the Chair.

Mr. H. B. FANTHAM, B.Sc., F.Z.S., exhibited original drawings of *Spirochæta anodontæ* from the crystalline style and intestine of *Anodonta cygnea*. This was the first record of the occurrence of this parasite in the British Pond-Mussel, though Keysselitz recorded probably the same organism from *Anodonta mutabilis* about a year ago, without giving its dimensions. The organism was found to be about 40 μ long and about 0·7 μ broad, with pointed ends and an undulating membrane. Its motion was most rapid, but seemed to be both spiral and vibratory.

The SECRETARY exhibited photographs of a young male African Elephant now living in the Bronx Zoological Park, New York, and probably the type of *Elephas africanus pumilio* Noack, from the French Congo. The photographs had been given him by Mr. W. T. Hornaday, C.M.Z.S. He remarked on the distinctness of the race, and pointed out the existence in the specimen of an undescribed peculiarity in the trunk.

Dr. WILLIAM E. HOYLE read a paper, illustrated by lantern-slides, on the Cephalopoda of Zanzibar and East Africa collected by Mr. Cyril Crossland in 1901–1902. He stated that the collection was not extensive either in point of individuals or species, and that a large proportion were young individuals to which it was impossible to affix definite names in the present state of our knowledge.

Five were identical with forms contained in a collection

---

* This Abstract is published by the Society at 3 Hanover Square, London, W., on the Tuesday following the date of Meeting to which it refers. It will be issued, free of extra charge, to all Fellows who subscribe to the Publications, along with the 'Proceedings'; but it may be obtained on the day of publication at the price of *Sixpence*, or, if desired, sent post-free for the sum of *Six Shillings* per annum, payable in advance.

recently made by Professor Herdman near Ceylon, whilst others occurred also in the Red Sea, thus showing a marked similarity in the Cephalopod-fauna of the whole of this region.

Advantage had been taken by the presence of several specimens of *Sepioteuthis loliginiformis* to give a full description of that species.

Some Octopod embryos showed epidermal structures very similar to, if not identical with, those described by Chun as constituting a bristle coat in young Octopods, and an account of these, as full as the material allowed, was given.

Mr. Oldfield Thomas, F.R.S., contributed the fifth of the series of papers on the Mammals collected by Mr. M. P. Anderson during the Duke of Bedford's Exploration of Eastern Asia. The present paper gave an account of a collection from Central Korea, just north and south of Seoul, the capital. 73 specimens were dealt with, belonging to 13 species, of which several were new, additional to those already discovered by Mr. Anderson during a previous visit to the southern part of the peninsula.

Mr. Aubyn Trevor-Battye, M.A., F.L.S., F.Z.S., read a paper on some new buildings in Continental Zoological Gardens, based upon recent visits to those of Stellingen, Hamburg, Berlin, Dresden, Breslau, Vienna, Budapest, Frankfort-am-Main, Amsterdam, Düsseldorf, Rotterdam, and Antwerp. By the kindness of their Directors he was able to show the plans of the new Rodents' House, Berlin, and of the Monkey House, Departmental, Storage, Isolation, and Infirmary Buildings, Rotterdam. He also showed diagrams of important erections in Breslau, Cologne, and elsewhere. He called attention to the greater use of glass abroad than with us, to the tendency to get rid, as far as possible, of iron bars, to improved methods of heating, lighting, and ventilation, and to the increased recognition of the fact that great warmth was usually a mistake (excepting in the case of Reptilia), since many animals from warm countries would thrive out-of-doors in the cold, provided they had plenty of food and means of exercise.

The next Meeting of the Society for Scientific Business will be held on Tuesday, the 28th May, 1907, at half-past Eight o'clock p.m., when the following communications will be made:—

1. Dr. G. Elliot Smith.—On the Form of the Brain in the Extinct Lemurs of Madagascar, with some Remarks on the Affinities of the Indrisinæ. (Appendix to Mr. H. F. Standing's paper "On recently Discovered Subfossil Prosimiæ from Madagascar.")

2. Mrs. O. A. Merritt Hawkes.—On the Abdominal Viscera and a Vestigial Seventh Branchial Arch in *Chlamydoselachus*.

3. Mr. G. A. Boulenger, F.R.S.—Second Report on the Batrachians and Reptiles collected in South Africa by Mr. C. H. B. Grant, and presented to the British Museum by Mr. C. D. Rudd.

The following Paper has been received :—

Mr. James Ritchie, M.A.—Some Collections of the Cape Verde Islands Marine Fauna, made by Cyril Crossland, July to September 1904.—Hydroids.

Communications intended for the Scientific Meetings of the Zoological Society of London should be addressed to

P. CHALMERS MITCHELL, *Secretary*.

3 Hanover Square, London, W
May 14*th*, 1907.

No. 46.

ABSTRACT OF THE PROCEEDINGS

OF THE

ZOOLOGICAL SOCIETY OF LONDON.*

May 28th, 1907.

Dr. J. Rose Bradford, F.R.S., Vice-President, in the Chair.

The Secretary read a report on the additions that had been made to the Society's Menagerie during the month of April 1907.

The Secretary exhibited a specimen of the patent Falconnier Glass Bricks, which had been referred to by Mr. Trevor-Battye at the last scientific meeting of the Society, as specially suitable for the construction of menagerie buildings.

The Secretary also exhibited a frontlet bearing a fine pair of horns of the Tákin (*Budorcas taxicolor* Hodgson). The specimen had been given to Mr. A. St. Clair B. Carnegy by Mr. Charles T. Forbes, of Badipar, Assam, who had obtained it from the Rajah of the Kampti Country.

Dr. H. Hammond Smith exhibited and made remarks upon a collection of the grits from the gizzards of the Game-birds of England, Scotland, and Wales.

Dr. C. W. Andrews, F.R.S., communicated a paper, illustrated by lantern-slides, by Dr. G. Elliot Smith, of the School of Medicine, Cairo, on the form of the Brain in the Extinct Lemurs of Madagascar, with some remarks on the affinities of the *Indrisinæ*. It formed a supplement to the paper on recently-discovered subfossil Prosimiæ from Madagascar, read before the Society by

---

* This Abstract is published by the Society at 3 Hanover Square, London, W., on the Tuesday following the date of Meeting to which it refers. It will be issued, free of extra charge, to all Fellows who subscribe to the Publications, along with the 'Proceedings'; but it may be obtained on the day of publication at the price of *Sixpence*, or, if desired, sent post-free for the sum of *Six Shillings* per annum, payable in advance.

Mr. H. F. Standing on March 19th. From an examination of cranial casts of an extinct species of Lemur and of *Mesopropithecus* and *Palæopropithecus*, and of brain-casts of *Nesopithecus* and *Megaladapis*, in conjunction with information derived from the study of recent Lemurs, the Author had arrived at the conclusion that *Propithecus*, *Avahis*, *Indris*, *Mesopropithecus*, *Nesopithecus*, *Palæopropithecus*, *Chiromys*, and *Megaladapis* must be regarded as the diversely specialised members of one family, all of which exhibited in greater or less degree distinct evidence of retrogressive changes from a more primitive and also more pithecoid type.

Some Notes on the Abdominal Viscera of *Chlamydoselachus*, contributed by Mrs. O. A. Merritt Hawkes, M.Sc., comprised observations on the alimentary canal, including the associated glands, the dentition, and the spiral valve of this Fish. The results were compared with the accounts of these organs previously given by Garman and Günther, and attention was directed to any discrepancies which had been noted. The female reproductive organs were also examined, and evidence was cited supporting the conclusion that *Chlamydoselachus* was viviparous. The interesting discovery was recorded that a vestigial seventh branchial arch was present.

Mr. G. A. Boulenger, F.R.S., read a second Report on the Batrachians and Reptiles collected in South Africa by Mr. C. H. B. Grant, and presented to the British Museum by Mr. C. D. Rudd. The Report dealt with 58 species—19 Batrachia and 39 Reptilia—of which two were described as new.

Mr. James Ritchie, M.A., B.Sc., of the University of Aberdeen, communicated a paper on the Hydroids of the Cape Verde Island Marine Fauna collected by Mr. Cyril Crossland, F.Z.S. The collection contained 27 species, and added considerably to our rather meagre knowledge of the Hydroid fauna of the northerly portions of the West Coast of Africa. The majority of the specimens hitherto described from Cape Verde Island had been obtained in comparatively deep water, but the present collection was a littoral one, and contained examples of only one species before recorded from the locality, viz. *Sertularia versluysi* Nutting. Of the 27 species represented in the collection 18 were already known, while the remaining 9 were described as new to science. Of the new forms the most interesting was a Gymnoblast, the peculiar branching and simple gonophore of which separated it so widely from known genera that a new genus had been established for it.

The next Meeting of the Society for Scientific Business will be held on Tuesday, the 18th June, 1907, at half-past Eight o'clock P.M., when the following communications will be made :—

1. Dr. F. W. JONES, F.Z.S.—On Growth-forms and supposed Species in Corals. (Illustrated by lantern-slides.)

2. Mr. R. T. GÜNTHER, M.A.—Notes on Limnocnida from Lakes Tanganyika and Victoria Nyanza.

3. Mr. G. A. BOULENGER, F.R.S.—On *Lacerta ionica* Lehrs, a Variety of *Lacerta taurica* Pallas.

4. Mr. HAMILTON H. DRUCE, F.Z.S.—On Neotropical *Lycænidæ*, with Descriptions of new Species.

5. Mr. C. TATE REGAN, F.Z.S.—Descriptions of *Velifer hypselopterus* and a new Fish of the Genus *Velifer*.

6. Mr. C. TATE REGAN, F.Z.S.—On the Anatomy, Classification, and Systematic Position of the Teleostean Fishes of the Sub-order Halotriognathi.

7. Mr. R. I. POCOCK, F.L.S., F.Z.S.—A Monographic Revision of the Monkeys of the Genus *Cercopithecus*.

8. Mr. R. I. POCOCK, F.L.S., F.Z.S.—Notes upon some African Species of the Genus *Felis* recently exhibited in the Zoological Gardens.

The following Paper has been received :—

Mr. MARTIN JACOBY, F.E.S.—Descriptions of new Species of South-American Cryptocephalini.

Communications intended for the Scientific Meetings of the ZOOLOGICAL SOCIETY OF LONDON should be addressed to

P. CHALMERS MITCHELL, *Secretary*.

3 HANOVER SQUARE, LONDON, W.
June 4th, 1907.

No. 47.

ABSTRACT OF THE PROCEEDINGS

OF THE

ZOOLOGICAL SOCIETY OF LONDON.*

June 18th, 1907.

G. A. BOULENGER, Esq., F.R.S., Vice-President, in the Chair.

The SECRETARY read a Report on the additions that had been made to the Society's Menagerie during the month of May 1907.

Mr. H. O. BAX-IRONSIDE, H.B.M. Minister to Venezuela, exhibited a series of eighteen models of Venezuelan animals. The models had been made from living specimens by a native Indian, the material employed being Ballata gum.

Mr. C. J. GAHAN exhibited the female of a luminous Beetle of a species of *Phengodes* from Manaos, Brazil.

Mr. C. L. BOULENGER exhibited and made remarks on a new Hydromedusan of which examples of both polyp and medusa stages were obtained by Dr. Cunnington and himself during their recent exploration of the lake Birket Gurun in the Fayum.

The medusa, for which Mr. Boulenger proposed the name *Moerisia lyonsi*, g. & sp. n., was an Anthomedusan which appeared closely related to *Sarsia*.

The hydroid was gymnoblastic and resembled *Cordylophora*, differing, however, from that genus in possessing a more complex mode of branching, and in the situation of the gonophores, which were on the polyps themselves.

Mr. R. I. POCOCK exhibited two young examples of the Common Squirrel which had undergone a peculiar change in colour.

---

* This Abstract is published by the Society at 3 Hanover Square, London, W., on the Tuesday following the date of Meeting to which it refers. It will be issued, free of extra charge, to all Fellows who subscribe to the Publications, along with the 'Proceedings'; but it may be obtained on the day of publication at the price of *Sixpence*, or, if desired, sent post-free for the sum of *Six Shillings* per annum, payable in advance.

Dr. F. W. Jones, F.Z.S., read a paper entitled "On the Growth-forms and supposed Species in Corals," in which he showed that the growth-form of the colony was the outcome of the conditions of the environment, and was not a specific character. The growth-form was largely the result of the method of division of the zooids of the colony, and different external conditions produced different methods of division, so that almost any coral could show almost any method of division. Every coral had three innate tendencies of growth, viz.: (1) to grow on the lines of an inherited growth-form, (2) to grow upwards, and (3) to oppose its maximum area to the line of currents. The conditions of the environment modified these tendencies, *e. g.*:—(1) Rough water caused: (*a*) building dense skeleton, (*b*) the corallites to be flush with the general surface, (*c*) the whole growth to be rounded or flattened. (2) Deep water caused: (*a*) building of light porous skeleton, (*b*) the loss of pigmentation, (*c*) the production of long attenuated branches. (3) Sediment in the water caused: (*a*) the raising and narrowing of the corallites, (*b*) the sculpturing of the intermediate spaces, (*c*) the production of stunted and amorphous forms. Coloration was no criterion of a species. The question of injury was a most important one in the production of growth-forms, and an injured colony might repair itself by a form of growth different from its original type. The various conditions of the environment produced an endless series of variations, but these were mere modifications of a few "species"; and in many cases a large colony might be broken up and its various fragments referred to many different named "species." The study of the zooid, the study of the development of identical embryos exposed to different environments, and the noting of the range of variation *in situ*, were the only methods by which the determining of the limits of a "species" among the corals could be arrived at.

Mr. G. A. Boulenger, F.R.S., read a paper on the Lizard of the Ionian Islands which had been named *Lacerta ionica* by Herr Philip Lehrs. He stated his opinion that this Lizard was not entitled to specific rank and that it was merely a variety of *Lacerta taurica* Pallas.

Mr. Hamilton H. Druce, F.Z.S., communicated a paper on "Neotropical Lycænidæ," in which a large number of new forms were described and the synonymy of many others discussed.

Six cabinet drawers containing a representative series of the group were exhibited.

A communication from Mr. C. Tate Regan, M.A., F.Z.S., contained descriptions of *Velifer hypselopterus* and of a new fish of the genus *Velifer*.

A second communication from Mr. Regan, entitled "On the Anatomy, Classification, and Systematic Position of the Teleostean Fishes of the Sub-order Halotriognathi," showed that the Lamprididæ, Veliferidæ, Trachypteridæ, and Lophotidæ formed a natural group closely related to the Beryciformes, from which they differed especially in the structure of the mouth. The maxillaries were protractile and had well-developed inner posteriorly directed processes, which moved backwards and forwards in a pair of grooves on each side of a median keel on the antero-superior face of the vomer; whereas in the Beryciformes the maxillaries were articulated to the vomer, and each had a ligamentous attachment to a process of the palatine, which prevented any movement other than the rotation forward of the distal extremity. The Halotriognathi were divided into Selenichthyes (*Lampris*), Histichthyes (*Velifer*), and Tæniosomi (Trachypteridæ and Lophotidæ). Reasons were given for believing that the Beryciformes were directly derived from Clupeoid Malacopterygians.

Mr. R. I. Pocock gave a brief abstract of a monograph of the Monkeys of the genus *Cercopithecus* and pointed out that all the known forms of this genus might be arranged into groups typified by the following species:—*patas*, *æthiops*, *petaurista*, *cephus*, *nictitans*, *leucampyx*, *albigularis*, *mona*, *neglectus*, *l'hoesti*, and *diana*.

Mr. R. I. Pocock also read a paper upon some African species of *Felis*, based upon specimens exhibited in the Society's Gardens. He drew special attention to some interesting points connected with *F. nigripes*, *F. serval* and *servalia*, and *F. aurata* (=*chrysothrix*). A specimen of the last-named species from Sierra Leone changed from red to dusky grey while living in the Gardens, thus proving that the differences in colour between individuals of this species were not of specific or subspecific value.

Mr. R. T. Günther contributed a paper on the Jelly-fish of the genus *Limnocnida* collected during the Third Tanganyika Expedition. The material had been obtained on four distinct dates in September, November, and February, by Dr. W. A. Cunnington, and therefore during the season of the great rains. The greater number of specimens in all the collections showed a vigorous growth of young medusa-buds on the manubrium, and that therefore the theory that asexual reproduction occurred during the dry season only, which was propounded by Mr. Moore, must be abandoned.

Dr. Cunnington's material threw new light upon the order and succession in which the tentacles developed, and had enabled the author to record all the stages of tentacle development as exhibited by individuals ranging from 2 mm. to 22 mm.

Certain variations in the arrangement of radial canals and of sense-organs were discussed. As large a percentage as 24 % were found to possess 5 or more radial canals, the greatest number being 7 instead of the normal 4.

The Victoria Nyanza form of *Limnocnida* collected by Sir C. Eliot, F.Z.S., which was also dealt with in the paper, was believed to be a variety, which differed from the Tanganyika form in that the tentacles were more deeply imbedded in ridges of jelly of the exumbrella than in the Tanganyika form. All the individuals in a collection from the Victoria Nyanza were females.

The result of a reinvestigation of both *Limnocnida* and *Limnocodium* had led the author to the conclusion that both genera were to be referred to the Trachomedusæ, in spite of the fact that no other known Trachomedusan had gonads on the manubrium. Reasons for this view were given as also for the association of both freshwater medusæ with the Olindiadæ. It was considered exceedingly doubtful whether either *Limnocodium* or *Limnocnida* ever passed through a hydroid stage at all.

This Meeting closes the Session 1906–1907. The next Session (1907–1908) will commence in November next.

The following Papers are in hand :—

1. Mr. Martin Jacoby, F.E.S.—Descriptions of new Species of South-American Cryptocephalini.

2. Mr. Knud Andersen.—A Monograph of the Chiropteran Genera *Uroderma*, *Enchisthenes*, and *Artibeus*.

3. Mr. E. S. Russell, M.A.—Environmental Studies on the Limpet.

Communications intended for the Scientific Meetings of the Zoological Society of London should be addressed to

P. CHALMERS MITCHELL, *Secretary*.

3 Hanover Square, London, W.
June 25*th*, 1907.

CONTENTS (*continued*).

June 18, 1907.

LIST OF PLATES.

1907, pp. 447–746.

NOTICE.

The 'Proceedings' for the year are issued in *four* parts, paged consecutively, so that the complete reference is now P. Z. S. 1907, p. . . . The Distribution is as follows:—

Papers read in January and February, issued in June.
„ „ March and April, „ „ August.
„ „ May and June, „ „ October.
„ „ November and December, „ „ April.

'Proceedings,' 1907, pp. 237–446, were published on August 1st, 1907.

NOTICE TO BINDER.—A cancel page is issued with this Part to replace 1907, p. 398, on which the block was reversed.

The Abstracts of the papers read at the Scientific Meetings in May and June are contained in this Part.

PROCEEDINGS

OF THE

GENERAL MEETINGS FOR SCIENTIFIC BUSINESS

OF THE

ZOOLOGICAL SOCIETY

OF LONDON.

1907.

PAGES 747–1121.

CONTAINING PAPERS READ IN

NOVEMBER AND DECEMBER.

MAY 1908.

PRINTED FOR THE SOCIETY,
SOLD AT THEIR HOUSE IN HANOVER SQUARE.

LONDON:
MESSRS. LONGMANS, GREEN, AND CO.,
PATERNOSTER ROW.

[*Price Twelve Shillings.*]

LIST OF CONTENTS.

1907, pp. 747–1121.

November 12, 1907.

November 26, 1907.

Contents continued on page 3 of Wrapper.

THE ZOOLOGICAL SOCIETY OF LONDON.

This Society was founded in 1826 by Sir Stamford Raffles, Mr. J. Sabine, Mr. N. A. Vigors, and other eminent Naturalists, for the advancement of Zoology and Animal Physiology, and for the introduction of new and curious subjects of the Animal Kingdom, and was incorporated by Royal Charter in 1829.

COUNCIL.

HIS GRACE THE DUKE OF BEDFORD, K.G., *President.*

George A. Boulenger, Esq., F.R.S., *Vice-President.*

Prof. John Rose Bradford, M.D., D.Sc., F.R.S., *Vice-President.*

Alfred H. Cocks, Esq.

The Rt. Hon. Earl of Cromer, P.C., G.C.B.

Charles Drummond, Esq., *Treasurer.*

Sir Edward Durand, Bt., C.B.

Frederick Gillett, Esq., *Vice-President.*

F. DuCane Godman, Esq., D.C.L., F.R.S., *Vice-President.*

The Marquis of Hamilton, M.P.

E. G. B. Meade-Waldo, Esq.

Prof. Edward Alfred Minchin M.A., *Vice-President.*

P. Chalmers Mitchell, Esq M.A., D.Sc., LL.D., F.R.S. *Secretary.*

The Lord Newton.

W. R. Ogilvie-Grant, Esq.

Albert Pam, Esq.

The Hon. Charles Rothschild, M.A.

David Seth-Smith, Esq.

Oldfield Thomas, Esq., F.R.S.

Aubyn Trevor-Battye, Esq., M.A.

Henry Woodward, Esq., LL.D. F.R.S., *Vice-President.*

The Society consists of Fellows, and Honorary, Foreign, and Corresponding Members, elected according to the By-Laws. It carries out the objects of its foundation by means of the collection of living animals at Regent's Park, by its Library at 3, Hanover Square, W., and by its scientific publications.

The Office of the Society (3, Hanover Square), where all communications should be sent, addressed to "The Secretary," is open from Ten till Five, except on Saturdays, when it closes at Two P.M.

The Library, under the superintendence of Mr. F. H. Waterhouse, is open daily at the above hours, except in September.

The Meetings of the Society for General Business are held at the Office on the Thursday following the third Wednesday in every month of the year, except in September and October, at Four P.M.

The Meetings for Scientific Business are held at the Office twice a month on Tuesdays, except in July, August, September, and October, at half-past Eight o'clock P.M.

The Anniversary Meeting is held on the 29th. April, or the nearest convenient day, at Four P.M.

The Gardens in the Regent's Park are open daily from Nine o'clock until Sunset. Mr. R. I. Pocock is the resident Superintendent. The Prosectorium for Anatomical and Pathological work at the Gardens is under the charge of Mr. Frank E. Beddard, M.A., F.R.S., Prosector, assisted by Mr. H. G. Plimmer, M.R.C.S., Pathologist to the Society.

TERMS FOR THE ADMISSION OF FELLOWS.

Fellows pay an Admission Fee of £5, and an annual Contribution of £3, due on the 1st. of January, and payable in advance, or a Composition of £45 in lieu thereof; the whole payment, including the Admission Fee, being £50.

No person can become a Fellow until the Admission Fee and First Annual Subscription have been paid, or the annual payments have been compounded for.

Fellows elected after the 31st. of August are not liable for the Subscription for the year in which they are elected.

PRIVILEGES OF FELLOWS.

Fellows have Personal Admission to the Gardens with Two Companions daily, upon signing their names in the book at the entrance gate.

The Wife or Husband of a Fellow can exercise these privileges in the absence of the Fellow.

Every Fellow is entitled to receive annually 60 undated Green Cards, and, when no specific instructions are received, the supply will be sent in this form. If preferred, however, 20 Green Cards may be exchanged for a book containing 2 Orders for each Saturday * throughout the year. A similar book of Sunday Orders may also be obtained in lieu of 20 Green Cards. A Green Card may also be exchanged for 2 Buff Cards for the use of Children under 12 years of age.

It is particularly requested that Fellows *will sign every Ticket* before it goes out of their possession. Unsigned Tickets are not available.

Green and Buff Tickets may be used on any day and in any year, but in no case can two Children be admitted with one Adult Ticket, or an Adult admitted with two Children's Tickets.

The annual supply of Tickets will be sent to each Fellow on the 1st. of January in every year, upon filling up and returning the form of Standing Order supplied to Fellows.

Fellows are not allowed to pass in friends on their written Order or on presentation of their Visiting Cards.

Fellows are exempt from payment of the fee for Painting, Sketching, and Photographing in the Society's Gardens.

Fellows have the privilege of receiving the Society's ordinary Publications issued during the year upon payment of the additional Subscription of One Guinea. This Subscription is due upon the 1st. of January, and must be paid before the day of the Anniversary Meeting, after which the privilege lapses. Fellows are likewise entitled to purchase these Publications at 25 per cent. less than the price charged to the public. A further reduction of 25 per cent. is also made upon all purchases of Publications issued prior to 1881, if above the value of Five Pounds.

Fellows also have the privilege of subscribing to the Annual Volume of 'The Zoological Record,' which gives a list of the Works and Publications relating to Zoology in each year, for the sum of

* The Saturday Orders are not available if the Fellow introduces friends personally on that day.

One Pound Ten Shillings. Separate divisions of volumes 39 to 42 can also be supplied. Full particulars of these publications can be had on application to the Secretary.

Fellows may obtain a Transferable Ivory Ticket admitting two persons, available throughout the whole period of Fellowship, on payment of Ten Pounds in one sum. A second similar ticket may be obtained on payment of a further sum of Twenty Pounds.

Any Fellow who intends to be absent from the United Kingdom during the space of one year or more, may, upon giving to the Secretary notice in *writing*, have his or her name placed upon the "dormant list," and will be thereupon exempt from the payment of the annual contribution during such absence.

Any Fellow, having paid all fees due to the Society, is at liberty to withdraw his or her name upon giving notice in *writing* to the Secretary.

Ladies or Gentlemen wishing to become Fellows of the Society are requested to communicate with the undersigned.

P. CHALMERS MITCHELL, M.A., D.Sc., LL.D., F.R.S.,
Secretary.

3 Hanover Square, London, W.,
May, 1908.

MEETINGS

OF THE

ZOOLOGICAL SOCIETY OF LONDON

FOR

SCIENTIFIC BUSINESS.

(AT 3 HANOVER SQUARE, W.)

1908.

Tuesday, May	12 and 26	Tuesday, November	3 and 17
,, June	16	,, December	15

The Chair will be taken at half-past Eight o'clock in the Evening precisely.

LIST OF THE PUBLICATIONS

OF THE

ZOOLOGICAL SOCIETY OF LONDON.

The scientific publications of the Zoological Society of London are of two kinds—"Proceedings," published in an octavo form, and "Transactions," in quarto.

According to the present arrangements, the "Proceedings" contain not only notices of all business transacted at the scientific meetings, but also all the papers read at such meetings and recommended to be published in the "Proceedings" by the Committee of Publication. A large number of coloured plates and engravings are issued in the volumes of the "Proceedings," to illustrate the new or otherwise remarkable species of animals described in them. Amongst such illustrations, figures of the new or rare species acquired in a living state for the Society's Gardens are often given.

The "Proceedings" for each year are issued in four parts, on the first of the months of June, August, October, and April, the part published in April completing the volume for the last half of the preceding year. From January 1901 they have been issued as two half-yearly volumes.

The "Transactions" contain such of the more important communications made to the scientific meetings of the Society as, on account of the nature of the plates required to illustrate them, are better adapted for publication in the quarto form. They are issued at irregular intervals.

Fellows and Corresponding Members, upon payment of a Subscription of One Guinea *before* the day of the Anniversary Meeting in each year, are entitled to receive the Society's Publications for the year. They are likewise entitled to purchase the Publications of the Society at 25 per cent. less than the price charged for them to the Public. A further reduction of 25 per cent. is made upon purchases of Publications issued prior to 1881, if they exceed the value of five pounds.

Fellows also have the privilege of subscribing to the Annual Volume of the Zoological Record for a sum of 30*s.* (which includes cost of delivery), payable on the 1st July in each year; but this privilege is forfeited unless the subscription be paid *before* the 1st of December following.

The following is a complete list of the publications of the Society already issued.

[*May*, 1908.]

TRANSACTIONS* OF THE ZOOLOGICAL SOCIETY OF LONDON.

4to. 16 vols. and Index.

			Price to Fellows.	Price to the Public.
Vol. I.,	containing 59 Plates	(1833–35)	£3 13 6	£4 18 0†
„ II.,	„ 71 „	(1835–41)	4 0 0	5 6 6†
„ III.,	„ 63 „	(1842–49)	3 8 3	4 11 0†
„ IV.,	„ 77 „	(1851–62)	6 2 0	8 2 6†
„ V.,	„ 67 „	(1862–66)	5 4 3	6 19 0
„ VI.,	„ 92 „	(1866–69)	11 5 0	15 0 0
„ VII.,	„ 73 „	(1869–72)	10 4 0	13 12 0
„ VIII.,	„ 82 „	(1872–74)	9 8 3	12 11 0
„ IX.,	„ 99 „	(1875–77)	12 1 6	16 2 0
„ X.,	„ 95 „	(1877–79)	10 0 3	13 7 0
Index, Vols. I.–X.		(1833–79)	0 7 6	0 10 0
Vol. XI.,	containing 97 Plates	(1880–85)	9 12 0	12 16 0
„ XII.,	„ 65 „	(1886–90)	5 8 0	7 4 0
„ XIII.,	„ 62 „	(1891–95)	6 8 3	8 11 0
„ XIV.,	„ 47 „	(1896–98)	5 5 0	7 0 0
„ XV.,	„ 52 „	(1898–1901)	5 15 6	7 14 0
„ XVI.,	„ 38 „	(1901–1903)	5 8 0	7 4 0
„ XVII.,	„ 41 „	(1903–1906)	5 18 6	7 18 0
„ XVIII., Pt. 1	„ 9 „	(Aug. 1907)	0 15 0	1 0 0
„ XVIII., „ 2	„ 19 „	(May 1908)	1 10 0	2 0 0

PROCEEDINGS OF THE COMMITTEE OF SCIENCE AND CORRESPONDENCE OF THE ZOOLOGICAL SOCIETY OF LONDON.

8vo. 2 vols. (Letterpress only).

			Price to Fellows.	Price to the Public.
Part I.	1830–31.	1 vol. 8vo.	4s. 6d.	6s.†
„ II.	1832.	„	4s. 6d.	6s.

PROCEEDINGS OF THE ZOOLOGICAL SOCIETY OF LONDON.

8vo. 15 vols. (Letterpress only) and Index. (First Series.)

			Price to Fellows.	Price to the Public.
Part I.	1833.	1 vol. 8vo.	4s. 6d.	6s.†
„ II.	1834.	„	4s. 6d.	6s.
„ III.	1835.	„	4s. 6d.	6s.
„ IV.	1836.	„	4s. 6d.	6s.
„ V.	1837.	„	4s. 6d.	6s.
„ VI.	1838.	„	4s. 6d.	6s.
„ VII.	1839.	„	4s. 6d.	6s.†
„ VIII.	1840.	„	4s. 6d.	6s.†
Part IX.	1841.	1 vol. 8vo.	4s. 6d.	6s.†
„ X.	1842.	„	4s. 6d.	6s.
„ XI.	1843.	„	4s. 6d.	6s.†
„ XII.	1844.	„	4s. 6d.	6s.
„ XIII.	1845.	„	4s. 6d.	6s.
„ XIV.	1846.	„	4s. 6d.	6s.†
„ XV.	1847.	„	4s. 6d.	6s.†
Index	1830–1847.	„	4s. 6d.	6s.

8vo. 13 vols. and Index. (Second Series.)

			Letterpress only. Price to Fellows.	Letterpress only. Price to the Public.	With Plates coloured. Price to Fellows.	With Plates coloured. Price to the Public.
Part XVI.	1848.	1 vol. 8vo.	4s. 6d.	6s.	£1 0 8	£1 7 6†
„ XVII.	1849.	„	4s. 6d.	6s.	1 0 8	1 7 6†
„ XVIII.	1850.	„	4s. 6d.	6s.	1 8 6	1 18 0†
„ XIX.	1851.	„	4s. 6d.	6s.	0 15 9	1 1 0†
„ XX.	1852.	„	4s. 6d.	6s.	0 15 9	1 1 0†
„ XXI.	1853.	„	4s. 6d.	6s.	0 18 0	1 4 0†
„ XXII.	1854.	„	4s. 6d.	6s.	0 19 6	1 6 0†
„ XXIII.	1855.	„	4s. 6d.	6s.	1 8 6	1 18 0†
„ XXIV.	1856.	„	4s. 6d.	6s.	1 0 8	1 7 6†
„ XXV.	1857.	„	4s. 6d.	6s.	1 0 8	1 7 6†
„ XXVI.	1858.	„	4s. 6d.	6s.	1 11 6	2 2 0†
„ XXVII.	1859.	„	4s. 6d.	6s.	1 11 6	2 2 0†
„ XXVIII.	1860.	„	4s. 6d.	6s.	1 11 6	2 2 0†
Index	1848–1860.	„	4s. 6d.	6s.		

† Out of print.

* In consequence of a re-arrangement of the stock of the 'Transactions,' the Society is now able to offer for sale, at the reduced price of £30, sets from Vol. v.–xvi. inclusive, and separate papers at about one-fourth their published price.

PROCEEDINGS OF THE SCIENTIFIC MEETINGS OF THE ZOOLOGICAL SOCIETY OF LONDON. 8vo. 40 vols. and 4 Indices.

	Letterpress only.		With Plates uncoloured.		With Plates coloured.	
	Price to Fellows.	Price to the Public.	Price to Fellows.	Price to the Public.	Price to Fellows.	Price to the Public.
1861	4*s.* 6*d.*	6*s.*	9*s.*	12*s.*	33*s.* 9*d.*	45*s.*†
1862	4*s.* 6*d.*	6*s.*	9*s.*	12*s.*	33*s.* 9*d.*	45*s.*†
1863	4*s.* 6*d.*	6*s.*	9*s.*	12*s.*	33*s.* 9*d.*	45*s.*†
1864	4*s.* 6*d.*	6*s.**	9*s.*	12*s.*†	33*s.* 9*d.*	45*s.*†
1865	4*s.* 6*d.*	6*s.*†	9*s.*	12*s.*	33*s.* 9*d.*	45*s.*
1866	4*s.* 6*d.*	6*s.*†	9*s.*	12*s.*†	33*s.* 9*d.*	45*s.*
1867			9*s.*	12*s.**	33*s.* 9*d.*	45*s.*
1868			9*s.*	12*s.*	33*s.* 9*d.*	45*s.*
1869			9*s.*	12*s.*	33*s.* 9*d.*	45*s.*
1870			9*s.*	12*s.*	33*s.* 9*d.*	45*s.*
Index, 1861–1870			4*s.* 6*d.*	6*s.*		
1871			9*s.*	12*s.**	33*s.* 9*d.*	45*s.*
1872			9*s.*	12*s.**	33*s.* 9*d.*	45*s.*†
1873			9*s.*	12*s.*	33*s.* 9*d.*	45*s.*
1874			9*s.*	12*s.*†	36*s.*	48*s.*†
1875			9*s.*	12*s.*	36*s.*	48*s.*
1876			9*s.*	12*s.*	36*s.*	48*s.*
1877			9*s.*	12*s.*	36*s.*	48*s.*
1878			9*s.*	12*s.*	36*s.*	48*s.*
1879			9*s.*	12*s.*	36*s.*	48*s.*
1880			9*s.*	12*s.*	36*s.*	48*s.*
Index, 1871–1880			4*s.* 6*d.*	6*s.*		
1881			9*s.*	12*s.*	36*s.*	48*s.*
1882			9*s.*	12*s.*	36*s.*	48*s.*
1883			9*s.*	12*s.*	36*s.*	48*s.*
1884			9*s.*	12*s.*	36*s.*	48*s.*
1885			9*s.*	12*s.*	36*s.*	48*s.*
1886			9*s.*	12*s.*	36*s.*	48*s.*
1887			9*s.*	12*s.*	36*s.*	48*s.*†
1888			9*s.*	12*s.*	36*s.*	48*s.*
1889			9*s.*	12*s.*	36*s.*	48*s.*
1890			9*s.*	12*s.*	36*s.*	48*s.*
Index, 1881–1890			4*s.* 6*d.*	6*s.*		
1891					36*s.*	48*s.*
1892					36*s.*	48*s.*
1893					36*s.*	48*s.*
1894					36*s.*	48*s.*
1895					36*s.*	48*s.*
1896					36*s.*	48*s.*
1897					36*s.*	48*s.*
1898					36*s.*	48*s.*
1899					36*s.*	48*s.*
1900					36*s.*	48*s.*
Index, 1891–1900			4*s.* 6*d.*	6*s.*		

* No perfect copies in stock. † Out of print.

PROCEEDINGS OF THE GENERAL MEETINGS FOR SCIENTIFIC BUSINESS OF THE ZOOLOGICAL SOCIETY OF LONDON.

8vo. 14 vols.

	Price to Fellows.	Price to the Public.
1901, vol. I.	18*s.*	24*s.*
,, ,, II.	18*s.*	24*s.*
1902, ,, I.	18*s.*	24*s.*
,, ,, II.	18*s.*	24*s.*
1903, ,, I.	18*s.*	24*s.*
,, ,, II.	18*s.*	24*s.*
1904, ,, I.	18*s.*	24*s.*
,, ,, II.	18*s.*	24*s.*
1905, ,, I.	18*s.*	24*s.*
,, ,, II.	18*s.*	24*s.*
1906, ,, I.	18*s.*	24*s.*
,, ,, II.	18*s.*	24*s.*
1907, ,, I.	18*s.*	24*s.*
,, ,, II.	18*s.*	24*s.*

LISTS OF THE ANIMALS IN THE SOCIETY'S GARDENS.

List of the Vertebrated Animals now or lately Living in the Gardens of the Zoological Society of London. (Eighth Edition.) 8vo. 1883. Cloth, 4*s.* 6*d.*

List of the Vertebrated Animals now or lately Living in the Gardens of the Zoological Society of London. (Ninth Edition.) 8vo. 1896. Cloth, 6*s.*; Paper, 5*s.*

Catalogue of the Library of the Zoological Society of London. (Fifth Edition.) 8vo. 1902. Cloth, 6*s.*; Paper, 5*s.*

These publications may be obtained at the SOCIETY'S OFFICE (*3, Hanover Square, W.*), *at Messrs.* LONGMANS' (*Paternoster Row, E.C.*), *or through any bookseller.*

THE ZOOLOGICAL RECORD.

THE object of the ZOOLOGICAL RECORD is to give, by means of an annual Volume, complete lists of the Works and Publications relating to Zoology in all its branches that have appeared during the year preceding the issue of the Volume, together with full information as to the points they deal with, arranged in such a manner as to serve as an Index to the literature of Zoology in all parts of the globe, and thus to form a repertory that will retain its value for the Student in future years.

All Members of the Zoological Society of London have the privilege of receiving the 'Record' at a subscription price of 30*s.* per annum, including the cost of delivery. This Subscription is due on the 1st of July in every year, and the privilege of Subscription is forfeited unless the amount be paid before the 1st of December following.

The Zoological Society is able to supply complete sets of the 'Zoological Record.' The first thirty-seven Volumes (1864–1900), and the Index-Volume (1880–1900) in addition, will be supplied for £15 net (or *without* the Index-Volume, for £14 10*s.* net). Volumes of any single year (exclusive of the last five volumes and Vols. 4 and 6) can likewise be supplied at 10*s.* per volume net.

INDEX ZOOLOGICUS. An alphabetical list of names of genera and subgenera proposed for use in Zoology, as recorded in the 'Zoological Record,' 1880–1900; together with other names not included in the 'Nomenclator Zoologicus' of S. H. Scudder. Compiled (for the Zoological Society of London) by CHARLES OWEN WATERHOUSE and edited by DAVID SHARP, Editor of the 'Zoological Record.' London, 1902. Price to Fellows, 18*s.*; price to the public, 20*s.*

Members of the Society wishing to subscribe to the 'Record' are requested to apply at this office for a Form, to be returned when filled up and signed by the subscriber. In order to facilitate the payment of the subscription, a Banker's Order Form is also supplied to those who prefer that mode of payment. This order, when filled up and signed, should be sent to the Society's office for registration; it will then be sent to the Agents named therein.

[P. T. O.

SEPARATE DIVISIONS OF THE ZOOLOGICAL RECORD.

Divisions of the 'Zoological Record,' Vols. 39–42, containing the literature of the years 1902–1905, may be obtained separately as follows:—

	s.	d.	
List of abbreviations of journals, etc. . . .	2	0	net.
Special Records, viz.:—			
I. General Subjects	2	6	,,
II. Mammalia	2	6	,,
III. Aves	6	0	,,
IV. Reptilia and Batrachia	2	6	,,
V. Pisces	2	6	,,
VI. Tunicata	1	0	,,
VII. Mollusca	4	0	,,
VIII. Brachiopoda	1	0	,,
IX. Bryozoa	1	0	,,
X. Crustacea	2	6	,,
XI. Arachnida	2	0	,,
XII. Myriopoda	1	6	,,
XIII. Insecta	12	0	,,
XIV. Echinoderma	3	6	,,
XV. Vermes	3	0	,,
XVI. Cœlenterata	1	6	,,
XVII. Spongiæ	2	0	,,
XVIII. Protozoa	2	0	,,
Index of new names of genera and subgenera . .	2	0	,,

Divisions from Vol. 43 onwards are now supplied by Messrs. Harrison & Sons, 46 St. Martin's Lane, London, W.C.

P. CHALMERS MITCHELL,
Secretary.

May, 1908.
ZOOLOGICAL SOCIETY OF LONDON,
3 HANOVER SQUARE, W.

November 12, 1907.

F. Du Cane Godman, Esq., D.C.L., F.R.S., Vice-President, in the Chair.

Report on Additions to the Menagerie during June to October 1907.

June.

The registered additions to the Society's Menagerie during the month of June were 210 in number. Of these 60 were acquired by presentation and 33 by purchase, 89 were received on deposit, 3 by exchange, and 25 were born in the Gardens. The total number of departures during the same period, by death and removals, was 222.

Amongst the additions special attention may be called to the following:—

A male Musk-Deer (*Moschus moschiferus*) from Chamba, presented by Major Rodon, F.Z.S., on June 16th.

A male Red Bird of Paradise (*Paradisea rubra*) from Waigiou, a male Twelve-wired Bird of Paradise (*Seleucides nigricans*) from Salwatti, and two pairs of King Birds of Paradise (*Cicinnurus regius*) from Aru Island, purchased on June 8th.

An Abyssinian Fruit-Pigeon (*Vinago waalia*), two Buff-breasted Partridges (*Ptilopachys fuscus*), a Black-billed Hornbill (*Lophoceros nasutus*), and two Black-backed Plovers (*Pluvianus ægyptius*) from Nigeria, presented by Miss Jardine on June 15th.

July.

The additions to the Society's Menagerie during the month of July were 364 in number. Of these 114 were acquired by presentation and 20 by purchase, 38 were received on deposit, 145 by exchange, and 47 were born in the Gardens. The total number of departures during the same period, by death and removals, was 273.

Amongst the additions special attention may be called to the following:—

A South-African Fennec (*Vulpes chama*) from S. Africa, purchased on July 3rd.

A Three-striped Phalanger (*Dactylopsila trivirgata*) from Salwatti, New Guinea, presented by Walter Goodfellow, Esq., F.Z.S., on July 26th.

A Collection of 139 Birds, principally from North America, including two White-headed Sea-Eagles (*Haliaëtus leucocephalus*), two Turkey Vultures (*Cathartes aura*), four Sulphur-breasted Toucans (*Rhamphastos carinatus*), as well as a large number of Thrushes, Finches, and other Passerine birds, representing many species new to the Collection: received in exchange from the Bronx Zoological Park, New York, on July 10th.

August.

The additions to the Society's Menagerie during the month of August were 185 in number. Of these 51 were acquired by presentation and 6 by purchase, 81 were received on deposit, 9 by exchange, and 38 were born in the Gardens. The total number of departures during the same period, by death and removals, was 152.

Amongst the additions special attention may be called to the following:—

A Simpai Langur (*Semnopithecus melalophus*), being the second example of this rare Monkey exhibited in the Gardens, deposited August 17th.

A Phillips's Dik-Dik (*Madoqua phillipsi*), new to the Collection, presented by Capt. M. J. Quirke, I.M.S., August 27th.

A female Mountain Zebra (*Equus zebra*), presented by A. W. Guthrie, Esq., F.Z.S., August 14th. The Society have now a pair of these Zebras.

A young Lammergeier (*Gypaëtus barbatus*), presented by F. Burgoyne, Esq., F.Z.S., August 28th.

September.

The additions to the Society's Menagerie during the month of September were 149 in number. Of these 68 were acquired by presentation, 2 by purchase, 65 were received on deposit, 4 by exchange, and 10 were born in the Gardens. The total number of departures during the same period, by death and removals, was 158.

Amongst the additions special attention may be called to the following:—

One female Giraffe (*Giraffa camelopardalis antiquorum*), born in the Menagerie on Sept. 20th.

One male Gayal (*Bibos frontalis*), born in the Menagerie on Sept. 6th.

Three Harnessed Antelopes (*Tragelaphus scriptus*), one Nagor Antelope (*Cervicapra redunca*), and two Side-striped Jackals (*Canis lateralis*), from Gambia, presented by Sir George Denton, K.C.M.G., F.Z.S., on Sept. 28th.

One Cayenne Kite-Falcon (*Leptodon cayennensis*), deposited on Sept. 30th.

OCTOBER.

The registered additions to the Society's Menagerie during the month of October were 214 in number. Of these 107 were acquired by presentation, 3 by purchase, 92 were received on deposit, 10 by exchange, and 2 were born in the Gardens. The total number of departures during the same period, by death and removals, was 140.

Amongst the additions special attention may be called to the following:—

Two Chinchillas (*Chinchilla lanigera*), presented by the Countess de Grey on Oct. 4th.

Five Viscachas (*Lagostomus trichodactylus*), three presented by the Countess de Grey on Oct. 4th, and two deposited on Oct. 26th.

A Spotted Cuscus (*Phalanger maculatus*), new to the Collection, purchased on Oct. 4th.

A Naked-throated Bell-bird (*Chasmorhynchus nudicollis*), deposited on Oct. 16th.

A Ground Hornbill (*Bucorvus abyssinicus*), deposited on Oct. 3rd.

Two Arizona Heloderms (*Heloderma suspectum*), deposited on Oct. 10th.

Mr. R. I. Pocock, F.L.S., the Superintendent of the Gardens, exhibited two photographs of a kitten bred in the Gardens between a male European Wild Cat (*Felis sylvestris*) and a female African Wild Cat (*Felis ocreata ugandæ*), and made the following remarks:—

The kitten was one of a litter of three born on August 14th. Two were eaten by the mother soon after birth, but the third was safely reared by a foster-cat. The three kittens were alike in pattern and resembled in all respects fairly typical domestic cats of the striped-tabby breed, as was shown by the photographs taken on Sept. 4th and Oct. 22nd, when the survivor was respectively about three and nine weeks old (text-figs. 194, 195, p. 750). This experiment in cross-breeding, although throwing no light upon the origin of the Blotched-tabby Domestic Cat, confirmed Mr. Pocock's opinion * that the Striped-tabby Domestic Cat of Europe was descended from the European and African Wild Cats (*Felis sylvestris* and *Felis ocreata*).

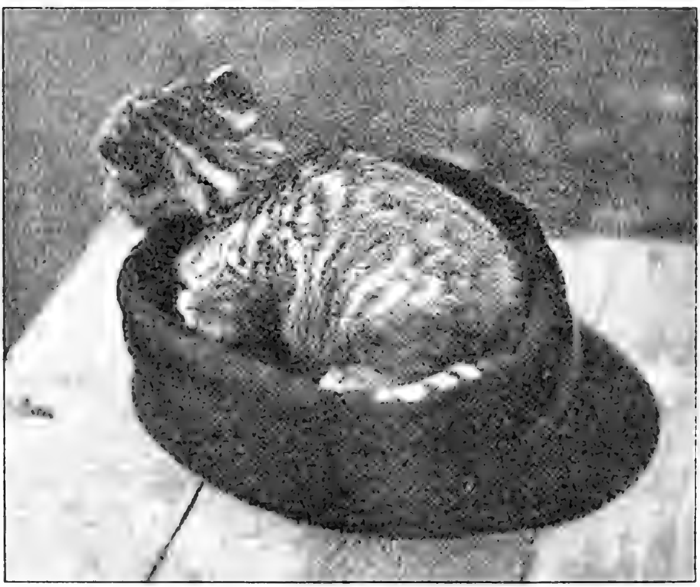
Mr. R. Lydekker, F.R.S., F.Z.S., exhibited, on behalf of the Hon. Walter Rothschild, the skins and horns of a male and female Takin from Bhutan, differing from the typical Mishmi form by its much smaller horns.

---

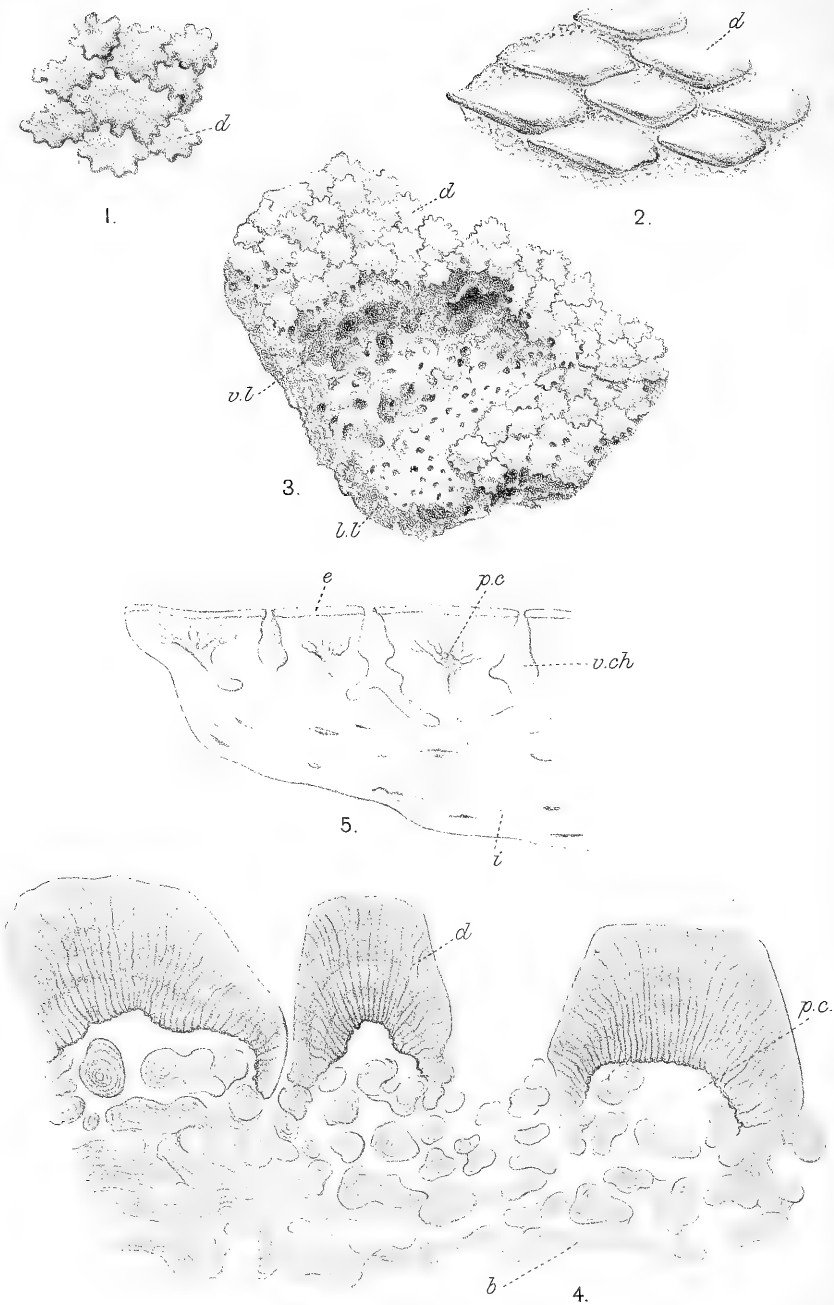
* P. Z. S. 1907, pp. 143–166.

Text-fig. 194.

Text-fig. 195.



Hybrid between a male European Wild Cat (*Felis sylvestris*) and a female African Wild Cat (*Felis ocreata ugandæ*) at nine weeks old (text-fig. 194) and at three weeks old (text-fig. 195).



E.S.G. del.

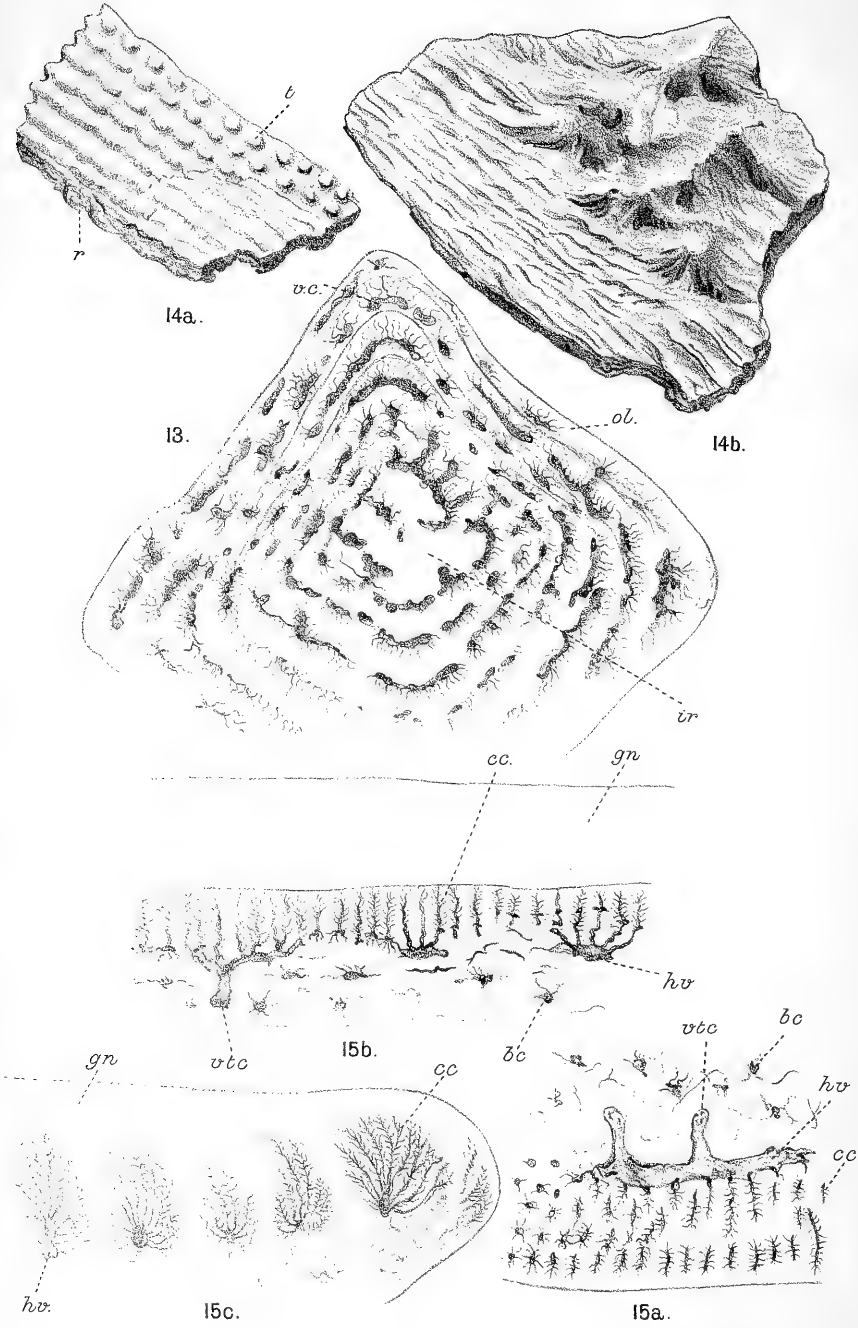
SCALES OF FISH.

E. Wilson, Cambridge.

E. S. G. del.

SCALES OF FISH.

E. Wilson, Cambridge.

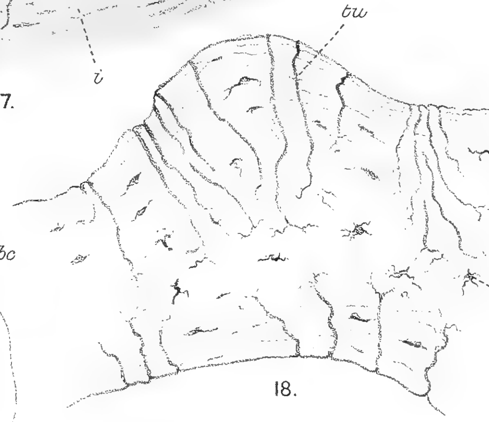


E. S. G. del.

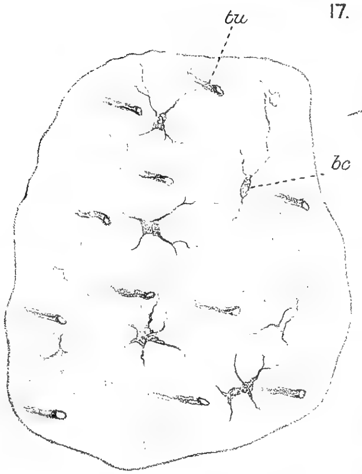
E. Wilson, Cambridge.

SCALES OF FISH.

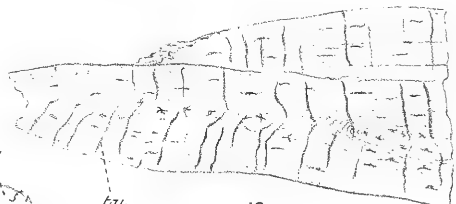
17.



18.

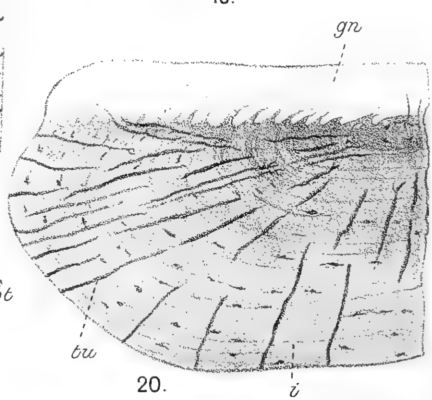


16.



19.

21.



20.

E. S. G. del.

E. Wilson, Cambridge.

SCALES OF FISH.

The following papers were read :—

1. On the Scales of Fish, Living and Extinct, and their importance in Classification. By Edwin S. Goodrich, F.R.S., F.Z.S., Fellow of Merton College, Oxford.

[Received November 12, 1907.]

(Plates XLIII.–XLVI.* and Text-figures 196–204.)

In a recently published paper on the Dermal Fin-rays of Fish (**3**), I remarked that the importance of the scales in classification seemed not to have received the attention it deserved. A careful study of the structure of the scales of living and extinct fish having confirmed this opinion, an account is here given of the results of my researches. Incomplete as these are, partly owing to the lack of material, they will be sufficient, I think, to show that the subject is full of interest, and well worthy of further study.

For the material used in the investigations I am to a great extent indebted to the generosity of various friends, among whom may be mentioned Dr. Traquair, Prof. Sollas, and Mr. Boulenger; but especially do I wish to express my thanks to Dr. A. Smith Woodward for help constantly rendered during my frequent visits to the British Museum.

Agassiz, in his classical memoirs on fossil fish (**1**), laid the foundation of the modern work on fish-scales, and it is well-known that he based his classification chiefly on their structure. But less generally known is it that more than half a century ago Williamson (**26** & **27**) published two most important papers on the scales of fish, of which he gave a very detailed and beautiful account. Not only was he able in many ways to complete and correct previous observations, to give the first accurate description of the minute structure of the scales of living and extinct Selachii, 'Ganoidii,' and Teleostei, but he also explained their mode of growth, and brought forward a theory of the origin of the various types of scales, and of their derivation from the primitive denticles of the Elasmobranch. Indeed Williamson's theory is in many respects superior to those modifications of it which have since been published by Hertwig (**7**), Klaatsch (**10**), and others. It may be added that in these remarkable papers Williamson clearly distinguished calcification of cartilage in the Elasmobranch from the various processes of the formation of true bone he described in other fish. His theories will be discussed later on (pp. 759–760); but it may here be mentioned that he considered that the superficial layer of the scale of *Megalichthys* is formed by the combination of a layer of "cosmine," derived from denticles homologous with those of Elasmobranchs, with deeper layers of bone of independent origin. He believed the cosmine layer to be formed by the concrescence of "dermal teeth." He further showed that the outer

* For explanation of the Plates, see p. 774.

layers of a ganoid scale are not formed of true enamel, but are continuations of the lower layers which overlap on to the upper surface, the scale growing by the deposition of complete concentric lamellæ. The Teleostean scale he described as growing in the same way, and as derived from the Ganoid.

At the time Williamson made these interesting observations, the classification of fossil fish was in a very unsatisfactory state. Allied forms were frequently widely separated, or distantly related forms closely grouped together. It is not surprising, then, that the systematic importance of his work should have escaped the notice of ichthyologists as well as of the author himself. Now that the classification is so much better understood, we cannot help being struck by the value of the evidence afforded by his researches; and it is mainly for the purpose of calling attention to them that this paper has been written.

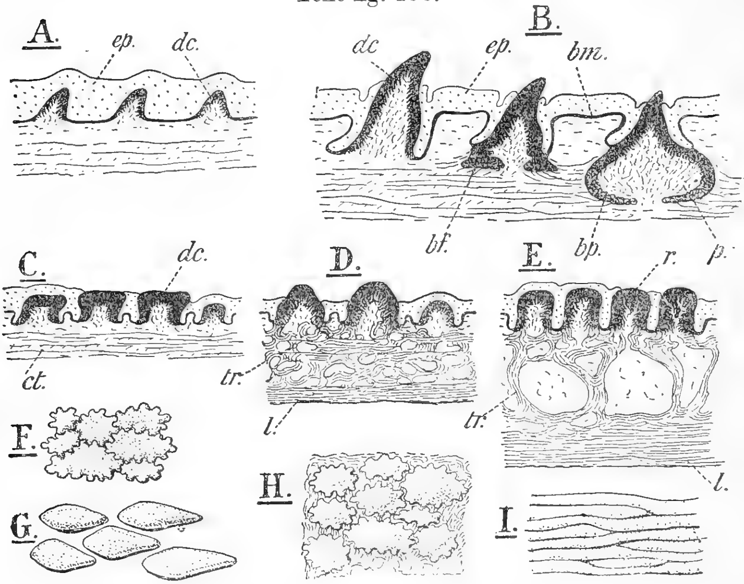
Types of Scale.

The Placoid Scale.—Little need be said concerning the denticles of Elasmobranch fish; attention must, however, be drawn to a few important points. True denticles are universally present in the living Elasmobranchs and their extinct allies. In structure they are remarkably constant, always consisting of a cap of dentine enclosing a pulp-cavity from which radiate numerous canaliculi (text-fig. 196). The cavity often becomes subdivided into branching canals uniting at the base, and giving off the dentinal tubules. The base is pierced by one or more openings through which the pulp can communicate with the surrounding mesoblastic tissues of the dermis. The dentine cap is covered on its outer surface with a layer of hard transparent enamel-like substance, the exact nature of which has given rise to considerable controversy. It is either true enamel deposited by the epidermis, or merely an outer specialised layer of dentine (Röse, **21**), or a combination of both (Tomes, **22**). For our present purpose we may call it enamel, allowing that Tomes' view is probably correct.

The important thing to notice is that from its earliest appearance in development onwards the dentine cap is in direct continuity with the basement membrane lying below the epidermis. Unlike bone, the dentine grows on one surface only, and that is the surface limiting the pulp-cavity. The placoid scale, then, always remains next to the epidermis, and never as a whole sinks down into the dermis (text-fig. 196). As it grows older it may, and generally does, acquire a well-marked basal plate of fixation (text-fig. 196, B). This plate is merely an extension inwards of the original cone, and it soon comes into connection with the deep fibrous layer of the cutis. As described by Hertwig (**6**), the connective-tissue fibres penetrate into the plate. Like the rest of the denticle, the basal plate is never composed of true bone, never contains bone-cells: it may be formed either of dentine, or of some less dense substance especially in its deeper parts. When the base is very large, as in the spines of Skates, the dentine may gradually change to a softer tissue composed of numerous trabeculæ surrounding irregular spaces. Since scleroblastic cells are free to pass on both sides of the ingrowing base, it can increase in size in all directions.

One may summarise the chief points thus:—The placoid scale, or denticle, begins as a cone of dentine deposited by mesoblastic scleroblastic cells below the epidermis, in continuity with the basement membrane; a basal plate may be present in the form of a direct extension inwards of the cone, never as a separate element which becomes fused on to it secondarily; both the cone and the plate are composed of dentine or some allied substance, never of true bone; the cone may pierce the epidermis, when fully grown.

Text-fig. 196.



(From Lankester's 'Treatise on Zoology,' by permission of Messrs. A. & C. Black.)

Diagrams of the structure and development of the dermal skeleton of A, an early stage, and B, later stages of Elasmobranchs; C, *Thelodus*; D, *Psammosteus*; E, *Pteraspis*, all in section at right angles to the surface; the dentine is black. F–I. Enlarged views of the outer surface of the dermal skeleton of F, *Thelodus* head, G, *Thelodus* tail, H, *Psammosteus* shield, and I, *Pteraspis* shield. *bf.*, expanded basal plate; *bm.*, basement membrane; *ct.*, connective tissue; *dc.*, dentine cap; *ep.*, epidermis; *l.*, bony lamellæ; *p.*, pulp-cavity; *r.*, surface ridge; *tr.*, bony trabeculæ of vascular layer.

Such denticles are found in the Selachii and Holocephali, which are devoid of other forms of scaling. Probably they also occur in the Pleuropterygii (Cladoselachii) and Ichthyotomi (Pleuracanthodii); though details concerning the histological structure of the scales of these fish are still lacking. Rarely the denticles seem to fuse together, as for instance in *Hybodus* (28). The circumorbital plates of *Cladoselache*, and the dermal plates of certain Holocephali (**29**) may also be of this nature, since they appear to be formed of dentine-like substance.

The Scales and Plates of the Heterostraci.—The important researches of Traquair (**23** & **24**) have disclosed a most interesting series of Palæozoic fish in which it appears to be possible to trace clearly the evolution of the bony carapace of the Pteraspids from the simple placoid scales of *Thelodus*. The latter (text-fig. 196, C & F) are broad and flattened denticles closely set in a mosaic on the head and trunk, and fitting together by their crenulated edges. In the tail region they lose the crenulations, are set farther apart, and are more spine-like in shape (text-fig. 196, G). Rohon (**18**) and Röse (**21**) have described their finer structure. The pulp-cavity is simple, and there is no distinctly marked basal plate. The whole scale is formed of typical dentine. *Psammosteus* is almost entirely covered with large plates (Traquair, **23**). Superficially these are studded with small denticles in every way similar to those of *Thelodus* (text-fig. 196, H). They have a rounded or pointed top, a wider base, and more or less closely-fitting crenulated edges. Below these denticles is a thick plate of bone-like tissue, which, however, is devoid of bone-cells. Since the structure of these plates has not been described in detail I give some figures of sections (Pl. XLIII. fig. 4, & text-fig. 196, D). An outer spongy layer, pierced in all directions by a network of vascular canals, occupies the greater thickness of the plate. It is indistinctly subdivided into two by a layer of lamellæ parallel with the surface. The inner side of the plate is strengthened with a thick lamellated layer. These skeletal structures have been deposited in successive laminæ, as is evidenced by the striation seen in sections (Pl. XLIII. fig. 4). The plate grows in thickness by the addition of new layers on its lower surface.

The denticles are of quite different structure, are composed of true dentine very like that of *Thelodus* (Pl. XLIII. fig. 4), and contain a pulp-cavity. They rest on the underlying plate, to which they become fixed, being fused to it here and there at their base. But they are sufficiently separate to be frequently broken off in specimens. These denticles grow, of course, by the addition of new matter below; and so the pulp-cavity becomes very shallow, and is not exposed even when the cone is much worn down.

It is but a step from *Psammosteus* to *Pteraspis*, whose exoskeleton has been well described by Huxley (**9**) and Lankester (**11**). Here the denticles already elongated in some regions of *Thelodus* have been converted into long narrow, closely fitting ridges (text-fig. 196, I). Pander figures a fragment of a plate, probably of *Psammosteus*, which shows most beautifully intermediate stages in the elongation of the denticles (**14**). Each ridge of the *Pteraspis* shield shows in transverse section the structure of a typical placoid scale, with numerous tubules radiating from the elongated pulp-cavity into the dentine. Very narrow deep valleys separate the dentine ridges, which may sometimes meet below. Traces of the crenulations may still be seen.

The underlying plate consists of an outer layer with very large vascular spaces, and a lamellated inner layer. The skeletal substance of which these are composed is quite similar to that of the *Psammosteus* plate.

Thus it appears that the shields of the Heterostraci, and also the scales and dermal fin-rays, have all been evolved by the combination of a covering of separate isolated denticles and an underlying plate, and the theory of Williamson is confirmed in a most remarkable manner by Traquair. But, and this is an important point, the superficial tubercles and the plate should not be compared to the pointed tip and expanded basal plate of an ordinary Selachian placoid scale. Throughout these changes the denticles remain essentially unaltered; the inner and continuous plate is evidently a quite distinct structure of separate origin—a new skeletal support doubtless developed in the cutis, and with which the denticles only came into secondary connection. In the most specialised forms (*Pteraspis*) the latter almost entirely lose their individuality, and acquire the deceptive appearace of being merely the ornamental surface of a scale or plate; yet they neither lose their characteristic tooth-like histological structure, nor do they really take part in the formation of the underlying plate.

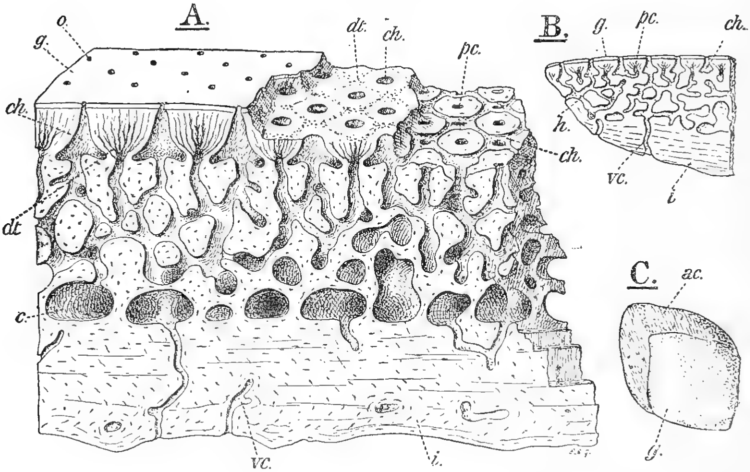
The true Scales.—Coming now to the fish with true scales, we first of all study those scales which have hitherto been grouped under the name "ganoid." Of these there are three types which can be clearly distinguished.

The Cosmoid Scale.—As an example of the first type, which may be called the "*cosmoid*" scale, we may take that of *Megalichthys*. It has been so well described by Williamson (26), that little need be said concerning its structure, which is shown in text-figs. 197 & 200. As usual, a basal layer is present composed of parallel bony laminæ of "isopedine," over which is a zone with large vascular spaces. Near the surface these canals combine to a more regular horizontal system forming a network passing round vertical canals, which reach the outer surface of the scale. It is the openings of these canals which give the pitted appearance to the shiny scales of the "Crossopterygian" fish. Below the surface the canals expand into conical chambers, between which pass upwards another set of vertical canals ending above in pulp-cavities. From these radiate a multitude of canaliculi.

A section parallel to the surface and just below it shows the conical chambers surrounded by a hexagonal pattern, formed by the cut ends of the dentine tubules (text-fig. 197). A section further down displays the pulp-cavities surrounded by the canals joining the chambers. This layer of vascular chambers and pulp-cavities disposed with such beautiful regularity may be considered as the highest development of "cosmine." Williamson gave this name to the peculiar dentine-like substance he discovered in "ganoid" scales. Unfortunately he also applied it to a very different bony tissue found in *Lepidotus* (p. 758). But in this paper the name cosmine will be restricted to a tissue with canaliculi like those of dentine, and the name "cosmoid" will be applied only to scales with an outer layer like that of *Megalichthys*.

The cosmine is restricted to that part of the outer surface of the scale which is exposed. Those regions which are overlapped by their neighbours in front have no cosmine, and are formed entirely of the two lower bony layers, the vascular and the isopedine (text-fig. 197, C). In both these are distributed numerous bone-cells. No such cells are found in the cosmine layer. The passage from the one to the other is gradual. Overlying the whole cosmine-covered surface is a thin layer of transparent glassy appearance and of homogeneous texture (text-fig. 197, A, & Pl. XLIII. fig. 5).

Text-fig. 197.



(From Lankester's 'Treatise on Zoology,' by permission of Messrs. A. & C. Black.)

Scale of *Megalichthys hibberti* Ag.; Carboniferous, England. A. Piece of a thick transverse section, much enlarged. B. Section through the hind edge, enlarged. C. Outer view of a scale. *ac.*, anterior region covered by next scale; *c.*, large vascular cavity; *ch.*, chamber of cosmine layer; *dt.*, canaliculi of cosmine; *g.*, thin outermost shiny layer; *h.*, irregular vascular canals; *i.*, bony inner layer or isopedine; *o.*, opening of chamber on surface; *pc.*, pulp-cavity from which canaliculi radiate; *v.c.*, vertical canal.

Now, such a cosmoid scale grows at its edge and lower surface. New cavities may be excavated in the vascular layer, or old ones filled up; but the increase in bulk of the scale as it grows older can only take place by the addition of new lamellæ of isopedine below, and by the deposition of substance, enclosing new chambers and pulp-cavities at the periphery (text-fig. 197, B). The cosmine layer with its thin enamel-like covering, is formed once and for all when it is first laid down. As far as one can judge from the examination of sections it does not materially alter with age. No new layers are deposited above it; such changes as take place are unimportant, and chiefly due to the filling up of the various spaces. The stratification of the isopedine indicates the lines of growth. Faint signs of laminæ are also visible in the walls of the vascular spaces.

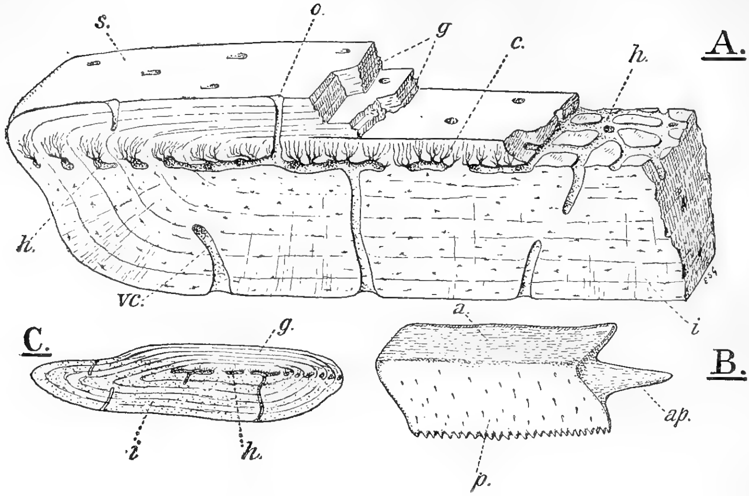
We may summarise the characters of the cosmoid scale as follows:—It has an outer layer of dentine-like substance with pulp-cavities and vascular chambers arranged in regular manner; a middle bony layer with vascular spaces; and an inner layer of bony laminæ, probably ossified fibrous tissue of the cutis. The cosmoid scale grows in thickness only by the addition of new lamellæ below; its outer surface is covered with a thin shiny layer, the nature and origin of which is uncertain.

The Ganoid Scale.—It is proposed to restrict the name "ganoid" to a type of scale found in all the Actinopterygii except the modern Teleostei. In its full development this type is represented by the rhombic scales of *Palæoniscus* and *Lepidosteus*. It differs radically from the cosmoid scale described above in that it grows in thickness by the addition of new layers not only below, but also on its upper surface. In fact concentric layers of new substance are continually being deposited over the whole surface; the oldest part of the scale is therefore at the centre. These layers, however, are not the same throughout; the lower being bony or fibrous, the upper of much denser homogeneous, enamel-like substance called ganoine by Williamson (text-fig. 198, C).

There are two distinct varieties of "ganoid" scale, differing in constant and important characters:—

The Palæoniscoid Scale.—*Gonatodus* or *Eurynotus* yields good examples of this type. The exposed surface of the scale is covered with a shiny layer of ganoine, pierced here and there by small vascular canals leading downwards into a horizontal network of canals (Pl. XLV. fig. 15, & text-fig. 198). From this again a few vertical canals pass downwards to open on the lower surface. The bulk of the scale, below the network of vascular spaces, is made up of the usual horizontal laminæ of bone, arranged in parallel layers. At the periphery these layers are bent upwards and, so to speak, turned over to form the laminæ of ganoine covering the outside of the scale. The two are continuous; but at their junction, just above the vascular spaces, is a cosmine-like layer penetrated by bunches of minute branching canaliculi passing upwards (fig. 15). Bone-cells are abundant below the vascular network, but none are found above it. Thus, in the Palæoniscoid scale, a layer of cosmine is interposed between the lower bony and the upper ganoine layers.

Text-fig. 198.



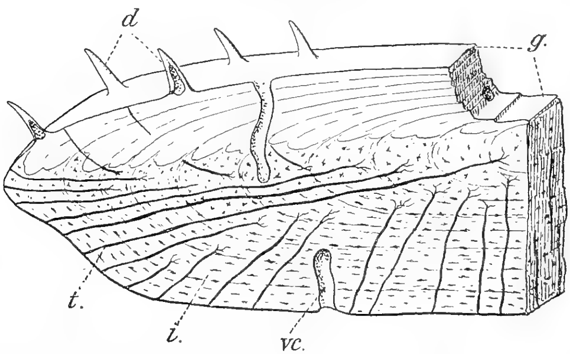
(From Lankester's 'Treatise on Zoology,' by permission of Messrs. A. & C. Black.)

Eurynotus crenatus Ag.; Lower Carboniferous. A. Diagrammatic and much enlarged view of a piece of the scale. B. Enlarged outer view of a scale. C. Transverse section of a scale, enlarged. *a.*, anterior covered region; *ap.*, articulating process; *c.*, fine canaliculi of cosmine layer; *g.*, ganoine layer; *h.*, system of horizontal canals; *i.*, isopedine layer; *o.*, opening on outer surface of vertical canals; *p.*, posterior exposed shiny surface; *s.*, outer surface; *vc.*, vertical canal.

During growth the three kinds of tissue are laid down simultaneously and in continuity; but the articulating peg and the flange which is overlapped by the neighbouring scales are formed of bone only.

The Lepidosteoid Scale.—While resembling the Palæoniscoid scale in its general appearance and mode of growth, the scale of *Lepidosteus* differs from it in two important particulars (text-figs. 199 & 200). In the first place there is no horizontal network of vascular canals giving off canaliculi—there is therefore no regular zone of cosmine. In the second place, the scale is pierced by a multitude of slender unbranched tubules passing inwards from the surface at right angles to the lines of growth (Pl. XLVI. fig. 20). These tubules converge therefore towards the central or oldest region of the scale, and many of them penetrate to quite near the ganoine. As has been well shown by Hertwig (**7**) and Nickerson (**13**), each tubule belongs to one cell, which lies on the surface of the scale and sends a long process down the tubule. At their inner extremities the tubules break up into minute branching twigs. In some cases, as for instance in *Lepidotus*, these fine branches pass upwards at the edges with some regularity, where the bony lamellæ merge into the ganoine. Williamson speaks of this region as cosmine; but the resemblance to the typical cosmine of *Megalichthys*, or even to the cosmine of Palæoniscids, is not at all close, and the two structures are probably not homologous. Since in the lepidosteoid scale there are neither pulp-cavities, nor vascular networks giving rise to canaliculi, it seems advisable not to apply to them the name cosmine at all. The tubules, with their inner branching ends, may very well merely represent modified bone-cells, which, instead of being buried in the matrix they produce, get carried outwards further and further from their first position as the scale grows older. They do not all start from the same region. Only the oldest tubules reach the central parts; younger ones start at various points among the later formed laminæ. Occasionally the tubules seem to traverse the ganoine in its outer and thinner region; but as a rule they either do not run upwards to the exposed surface or they get cut off by the newly deposited layers of ganoine, each of which of course extends a little further than the last (text-fig. 199).

Text-fig. 199.



(From Lankester's 'Treatise on Zoology,' by permission of Messrs. A. & C. Black.)

Much enlarged view of a piece of the scale of *Lepidosteus osseus* L. *d.*, superficial denticles; *g.*, ganoine layer; *i.*, inner bony layers, or isopedine; *t.*, tubules with branching inner ends; *vc.*, vascular canal.

We have seen what are the three chief kinds of scales commonly called ganoid: to the first it is proposed to give the name cosmoid, while the second and third are varieties of the true ganoid scale. Other and less important varieties exist and will be dealt with later on (p. 765).

Origin of the Cosmoid and Ganoid Scales.

According to Williamson's theory, which has already been mentioned, the cosmoid scale arose by the fusion of a large number of denticles, and their combination with a bony plate developed below. In fact the theory which we have just found to apply so admirably to the explanation of the plates of the Heterostraci, was put forward by Williamson to account for the structure of the scales and dermal plates of *Megalichthys* (**26**). Each pulp-cavity of the cosmine layer is supposed to indicate a single denticle. As representing an intermediate stage in the formation of cosmine, he pointed to the dermal bones of the Cœlacanth *Macropoma*. Here the denticles are clearly seen, either standing up as sharp teeth on the scales, or as more or less blunt protuberances on the cranial bones. The denticles in *Macropoma* retain their histological character and pulp-cavity, although they become fused to the underlying bone, and so deeply sunk in it, that they may be mistaken for a mere superficial ornamentation. Cosmine, says Williamson, is formed by "the confluent aggregation and superficial depression of a number of placoid teeth, surmounting a highly developed scale."

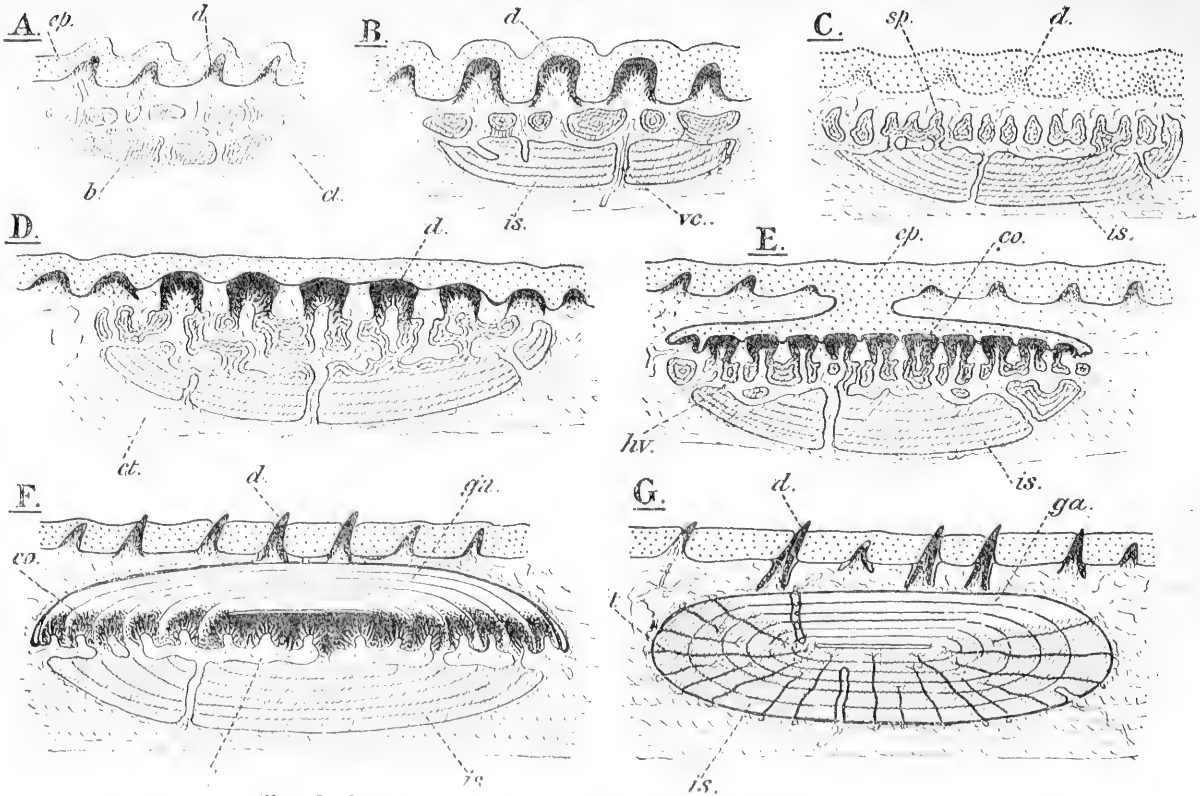
While cosmine grows from within, ganoine is deposited from without. The scale here called Palæoniscoid, Williamson believed to be formed by the overlapping of the bony laminæ at the edges, and their spreading out over the outer surface of the cosmine as an enamel-like layer. The ganoid scale, then, would be described as a cosmoid scale the edges of which have been turned over on to the outer surface.

These fascinating theories meet with many difficulties in the way of their adoption; difficulties which are probably not insuperable, but must be disposed of before Williamson's views can be considered as established.

First of all, it is a far cry from the scattered denticles of *Macropoma* to the complex cosmine of the Osteolepids. Most of Williamson's observations on *Macropoma* I can fully confirm. But I have looked in vain for any intermediate forms bridging over the gap between the two types of scale. The dentine-like substance of *Megalichthys* forms a continuous layer, without sign of subdivision externally; and the appearance of a series of crowded denticles seen in a section is chiefly due to the pulp-cavities and conical chambers being cut through alternately. Although so extraordinarily like the shield of *Pteraspis* in section, the two are really very different in structure. In the palæoniscoid scale the cosmine may be said to have lost any trace of the subdivision into separate denticles which it may once have possessed; and in the lepidosteoid scale no true cosmine occurs at all, according to my observations.

Pander, it is true, has given beautiful figures of sections of the dermal bones of *Glyptolepis*, showing how the superficial teeth may become fixed to the bone, and converted into cosmine-like tubercles (**15**); but I have failed to find anything quite like this in the material at my disposal. On the scales of *Glyptolepis* there appear to be no regularly disposed denticles, though here and there are tubercles which resemble rather the last remnants of disappearing cosmine than the incipient stages in its formation. Rohon, however, agrees with Pander, and supports

Text-fig. 200.



(From Lankester's 'Treatise on Zoology,' by permission of Messrs. A. & C. Black.)

Diagrams showing the possible origin of the "cosmoid" scale E, the Rhizodont scale C, the "palæoniscoid" scale F, and the "lepidosteoid" scale G, from a simple condition A through stage B, or B and D. A, B, D, hypothetical stages showing the fixation of superficial denticles, *d*, on to an underlying bony plate, *b*, pierced by vascular canals, *hv*; *co.*, cosmine layer derived from denticles, it is lost in C, and not developed in G. *ct.*, connective tissue of cutis; *ga.*, outer ganoine laminæ; *is.*, inner bony laminæ; *cp.*, epidermis; *sp.*, superficial spines and ridges.

the view that the tubercles in "*Dendrodus*" are denticles which have become fused on (**19**). This is an important point which requires further investigation.

With regard to the ganoid scale new difficulties arise. The cosmine layer in these is supposed to represent the thoroughly fused denticles. Williamson is not explicit on this point, and does not trace in detail the origin of the scale of *Palæoniscus* from that of *Megalichthys*. The denticles, we may suppose, have sunk away from the epidermis, and have become surrounded by concentric layers secreted by the mesodermal pocket in which the scale is now enclosed (text-fig. 200, E & F). But how on such a view can we account for the new formation of cosmine in each successive layer? In the case of the cosmoid scale, the outer layer, we might suggest, remained immediately below the epidermis, new denticles being continually added at the circumference. Such a ring of growth may be compared to a dental groove. These denticles might develop in the ordinary way from "germs" at the edge, and become fixed on during growth (text-fig. 200, D). The thin sheet of transparent substance covering the cosmoid scale would then represent the enamel. But, it may be urged, in the palæoniscoid scale the cosmine would soon become cut off from the epidermis, and it is difficult to see how new "germs" could be produced, and more especially how the newly formed denticles could come to occupy the position of the cosmine in the middle of each lamella at the junction between the ganoine and the bone. This objection is not fatal, for it must be remembered that the inner secreting surface of the pocket probably represents the original upper surface of the dermis as far as the edge of the scale, and therefore might well retain the power of producing new denticle "germs" at the periphery. In the series of diagrams (text-fig. 200, p. 761) I have endeavoured to illustrate this extension of Williamson's theory in accordance with more recently acquired evidence concerning the development of these various structures.

Of the development of a typical palæoniscoid scale we know nothing; but Nickerson (**13**) has given us a most excellent account of the development of the scale of *Lepidosteus*, which entirely bears out Williamson's view as to its mode of growth by concentric layers, and I have myself made observations on the development of the scales of *Polypterus* which lead me to the same conclusion.

Let us now examine a third difficulty which suggests itself. It is this: if the denticles are already represented in the cosmine, how comes it that the scales of *Polypterus*, which contain a cosmine layer (p. 770), have denticles set on their outer surface? This question brings us to the consideration of Hertwig's theory of the origin of scales and dermal bones.

Agassiz and Williamson described the denticles which are movably articulated to the surface of the dermal bones of certain Siluroid fish (*Hypostoma*, etc.); and Reissner (**17**) found similar small denticles fused to the surface of the scales of *Lepidosteus*. O. Hertwig, in a series of valuable papers on the dermal covering of fish, contributed a number of interesting observations on its structure and development. But, neglecting the work of Williamson, the importance of whose researches he failed to appreciate, Hertwig does not appear to have understood the growth of the ganoid scale, and moreover revived the old and fundamental error of calling the outer layer true enamel. Tracing the origin of all the scales and dermal bones of *Lepidosteus* to the fusion of small plates bearing a denticle, homologous with the placoid scale of the Elasmobranch, Hertwig concluded that originally these fish were provided with a general covering of denticles, that by concrescence their basal plates gave rise to scales, that enamel was deposited where such plates reached the surface, and that subsequently the denticles tended to disappear. Klaatsch, in his important paper on fish-scales (**10**), supports Hertwig's general theory; but considers that each scale of the higher fish represents a single denticle of which the basal plate has become much enlarged. "Die Ganoidschuppe ist der Placoidschuppe homolog, in so fern sie die alte Einheit fortführt. Sie entspricht in der Hauptmasse der Basalplatte, und zwar den tieferen Theilen derselben. Der Spitzentheil der Placoidschuppe ist rudimentär geworden. Die Ganoinschicht der Lepidosteus-schuppe entspricht den oberflächlichen Theil der Basalplatte. Den Zähnchen der Lepidosteusschuppe kommt keine morphologische Bedeutung zu." (p. 155.)

Nickerson also compares the ganoid scale to the placoid denticle on the supposition that the basal plate of the latter has given rise to the scale. The separate development of the dentine cone and of the plate in *Lepidosteus*, he would interpret as due to secondary modification (**13**).

The denticles on the scales of *Lepidosteus* and *Polypterus* are generally spoken of as degenerate vestigial structures usually absent in the adult, except in certain restricted regions. But there is reason to believe that the denticles are much more abundant and regularly distributed than is commonly supposed. They are to be found in adult specimens of both genera on the scales of the trunk where these have been protected from rough usage. Their absence in many specimens is due to a great extent, if not entirely, to their having been rubbed off. As Nickerson (**13**) has well shown in *Lepidosteus*, the denticles develop just like those of Elasmobranchs, on the surface of the mesoblastic tissue, and afterwards become fused on to the scale, in the formation of which they take no real part, except in so far as they may occasionally get buried in it. The same is the case in *Polypterus*, as my observations show.

The comparison of the denticle and ganoid scale with the conical apex and basal plate of the placoid denticle seems, therefore, to be fundamentally wrong. As already insisted upon, the basal plate is merely an extension of the denticle cone; there is no reason to think that it can ever develop separately. Nor is there any evidence that denticles do ever really contribute to form dermal bones. Even in the case of the palatal bones of fish and amphibians, the teeth do not actually combine to build up the supporting bone, but become fused sooner or later to bony substance independently developed at their base.

The history of the palæoniscoid variety of ganoid scale would seem be this (text-fig. 200, p. 761). It first arose as a dermal plate of bone to which became attached a number of denticles, eventually forming an outer layer of cosmine—the cosmoid stage. It then sank deeper into the dermis, which grew over the outer face, and so enclosed it in a mesoblastic pocket secreting complete concentric layers. The outer dermis continued to give rise to denticles, which thus came to be situated on the top of the sunken scale, and subsequently became attached to its surface. Whether the cosmoid scale ever was provided with such denticles is unknown. None have been described in extinct forms; and I have looked for them so far in vain. Possibly the cosmoid scale always remained close under the epidermis, and so there would have been no room for their development. At all events such denticles are only known to occur in *Lepidosteus*, *Polypterus*, and some Siluroids, and the extinct Cœlacanths (which have no true cosmoid or ganoid scales).

This hypothetical history of the cosmoid and palæoniscoid scales is illustrated in the diagrams (text-fig. 200, A to G).

Whether the lepidosteoid variety can be considered as a modification of the palæoniscoid type seems to me extremely doubtful. It is true that the scale of "*Dapidius granulosus*," as described by Williamson, might be taken as intermediate, but my own observations on this species do not confirm his description of cosmine tubules. Indeed this scale appears hardly to differ from the typical lepidosteoid form. Future research on fossil forms may perhaps enable us to determine what has been the history of the lepidosteoid scale—whether it has ever passed through a cosmoid stage.

So far we have merely developed, in a more modern form, Williamson's theory of the origin of the scales of the Teleostomi. It is obvious, however, that another view might be held. The alternative theory which can be put forward is simply this: that the outer layer of the cosmoid scale is merely a special region of the bony plate, which has come to acquire a dentine-like structure, and not a product of superficial denticles. This theory would differ from the first only in its account of the origin of the cosmine; the palæoniscoid scale would still be derived from the cosmoid as explained above. One of the chief difficulties to be met by this view, is that the more primitive and ancient fish (early Dipnoi, and Osteolepidoti (Crossopterygii)) have the most perfectly developed cosmine. On the whole Williamson's theory seems the best, though it cannot be considered as fully established until stages intermediate between the cosmine and the denticle have been discovered.

We have determined what are the three chief kinds of scale; let us now see of what importance they are in classification.

The Systematic Importance of the Scales in the DIPNOI *and* TELEOSTOMI.

The COSMOID *type and its derivatives.*—That type of scale which we have called cosmoid occurs only in the extinct Osteolepidoti (Crossopterygii) and in the Dipteridæ. In the thick rhombic scales of the Osteolepidæ it is most perfectly shown. The scale of *Megalichthys* has been fully dealt with above (p. 755). That of *Osteolepis* is quite similar, as may be seen in Pander's excellent figures (**15**). A section of the edge of the scale of *Osteolepis* is here figured, showing the outer layer of typical cosmine and the absence of stratified ganoine (Pl. XLIII. fig. 5). *Diplopterus* differs scarcely from *Megalichthys* (Williamson).

Now it is extremely interesting to find that the scale of *Dipterus* has exactly the same structure, for it has long been recognised that the Dipteridæ approach the Osteolepidoti (Crossopterygii) more closely than any other group of fish. The importance of this fact is enhanced by the knowledge that the cosmoid type occurs in no other Order. Pander's figures leave no doubt about the resemblance of the scale of *Dipterus* to that of *Osteolepis*. Unfortunately I have not had material favourable for sections; but the fragments I have examined confirm his descriptions. This cosmine layer is of such peculiar, elaborate and complex structure, that we cannot suppose it to have been independently developed in the two cases. There seems no escape from the conclusion that the common ancestor of the Osteolepidæ and Dipnoi had scales of this cosmoid type.

The evidence with regard to the other families of the Osteolepidoti (Crossopterygii) is not so clear. Various forms of scale occur among them; some of which are probably degenerate cosmoid scales, while others perhaps belong to some different though related type.

In the Holoptychiidæ the scales are usually rounded, and ornamented with tubercles and ridges. Williamson (see his fig. 24, plate 42) figures a section through the scale of *Holoptychius* showing an outer layer which is undoubtedly a stage either in the formation or in the degeneration of the typical cosmine structure. According to Rohon's careful account, the scale of *Holoptychius* (probably another species) is very like that of the Osteolepidæ, excepting for the outer layer. Instead of being built in the uniform and beautifully regular manner of typical cosmine, it is in the form of the irregular tubercles and ridges already mentioned; and these are composed of dentine-like tissue, resembling the cosmine layer of the palæoniscoid scale. There is no alternating system of pulp-cavities and chambers, but merely a vascular network from which arise branching dentinal tubules. Rohon considers that the tubercles represent denticles fused on to the surface; they appear to me rather to represent stages in the degeneration of cosmine, than in its formation. The same may be said of *Glyptolepis* (p. 760); here the middle vascular layer is to a great extent exposed, forming ridges on the upper face quite similar to those found on the scales of the Rhizodonts.

The scales of the Rhizodontidæ I have been able to examine, such as *Rhizodus*, *Strepsodus*, and *Eusthenopteron*, are rounded, relatively thin, and with a superficial ornamentation of ridges and tubercles (Pl. XLV. fig. 14). The bulk of the scale is made up of the usual parallel bony laminæ of isopedine, which merge above into the vascular layer. The ornamentations have no resemblance to cosmine in structure, and are directly continuous with the bony trabeculæ of the vascular layer, being formed of the same substance (Pl. XLIV. figs. 6 & 8). Where the tubercles are very large, they appear to be formed to a great extent by the upturning of the isopedine lamellæ at the growing edge of the scale (fig. 7). In some regions of the scale of *Rhizodus* this overturning of the laminæ is very pronounced; yet it never results in the deposition of a continuous covering, and only occurs at the edge. Nevertheless, in *Eusthenopteron* and *Rhizodus* the ornamentation seems to have grown, to some extent, by the addition of new bony layers on the outer surface; and we may suppose that, the cosmine having disappeared, the bone-forming cells of the middle layer emerged on the outer face and continued to secrete there. But when once formed, the middle layer itself does not appear to have grown appreciably in thickness, though new laminæ were always being added to the lower strata. The ridges are often very numerous and regular, with an elaborate network of canals below opening by many apertures on the surface at the bottom of the valleys. This structure is also seen in *Glyptolepis*; in which, however, here and there the tubercles have the appearance of cosmine (p. 760)*. *Gyroptychius*, alone among the Rhizodonts, has preserved a thick shiny scale; and here can be seen an outer layer of true cosmine as in *Osteolepis*.

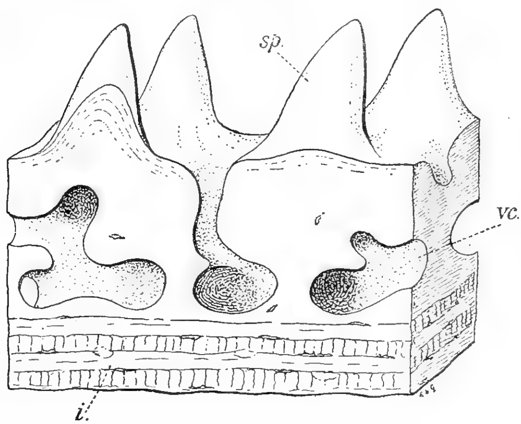
With regard to the Cœlacanthidæ our knowledge is still very incomplete. It has been clearly established by Williamson (26) that some genera such as *Macropoma* have typical denticles, with dentine cone and pulp-cavity, fused on to the outer surface of their scales and dermal bones (p. 760). His account I can fully confirm. The scale consists of an inner layer of isopedine, an intermediate layer with vascular canals, and lastly of the denticles on that hinder region which is not overlapped by neighbouring scales. In *Cœlacanthus* are found the first two layers; but instead of superficial denticles, there are elongated tubercles or shiny ridges which in section appear merely as hollow arches

* We shall await with the greatest interest a description of the scale of *Tarrasius*; doubtless it will throw much light on the problem of the systematic position of this very imperfectly known but important genus.

on the top of the scale (Pl. XLIV. fig. 12). Whether these tubercles represent modified denticles remains to be proved. A careful study of better preserved material, and of other genera, might settle this point.

Turning now to the Dipnoi, we find that *Dipterus* has typical cosmoid scales (p. 765). All the living genera have scales of very uniform structure (Wiedersheim **25**, Günther **5**, Klaatsch **10**); consisting of a basal layer of isopedine lamellæ, little if at all calcified, and an outer calcified layer. The latter closely resembles the outer vascular and ornamental layers of the scale of the Rhizodontidæ. A horizontal network of canals and space runs through the base of the calcified region, and opens by numerous pores between more or less well-defined ridges. A multitude of very small spines projects from the whole surface of the scale. The ridges and partitions separating the vascular spaces grow by the addition

Text-fig. 201.



(From Lankester's 'Treatise on Zoology,' by permission of Messrs. A. & C. Black.)

Enlarged view of a small portion of the scale of *Phaneropleuron curtum* Wht.; Upper Devonian, Canada. *i.*, inner bony layer; *sp.*, surface spinelet; *vc.*, vascular space.

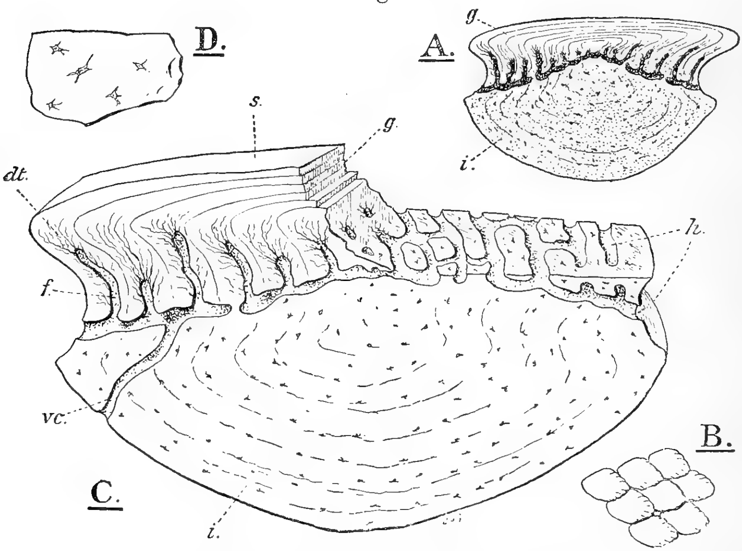
of new laminæ of bony substance without cells; and the spines are merely processes of the calcified layer developed in just the same manner. They are obviously analogous to the tubercles on the scale of the Rhizodonts, and like them are found all over the posterior covered as well as generally over the anterior exposed region. These spines have nothing to do with denticles, with which they have been compared by Wiedersheim (**25**); and differ from them radically both in structure and development. Wiedersheim's theory has already been disposed of by Klaatsch (**10**). Now it is very interesting to find that this peculiar "Dipnoan" type of scale is already perfectly differentiated in the

Devonian genera, *Phaneropleuron* and *Scaumenacia* (Pl. XLIV. figs. 10 & 11, and text-fig. 201). These fish have thin scales, without cosmine or ganoine, but studded all over with the same characteristic spines. This Dipnoan type of scale would seem to be a degenerate form derived from the cosmoid type of *Dipterus*, after the loss of the cosmine layer. We may expect to find intermediate scales among the other extinct Dipnoi.

The Ganoid Scales.—Ganoid scales, whether of the palæoniscoid or of the lepidosteoid type, are found only in the Actinopterygii (and Polypterini).

All the Palæoniscidæ and Platysomidæ I have been able to examine, have scales belonging to the Palæoniscoid type, differing

Text-fig. 202.



(From Lankester's 'Treatise on Zoology,' by permission of Messrs. A. & C. Black.)

Cheirolepis sp., L. Devonian. A. Transverse section of scale. B. Outer view of scales enlarged. C. Much enlarged view of a piece of a scale cut transversely. D. A fragment of the inner bony layer, magnified. *dt.*, canaliculi of cosmine layer; *f.*, vertical blind canals (pulp-cavities); *g.*, ganoine layer; *h.*, system of horizontal vascular canals; *i.*, inner bony layer, isopedine; *s.*, shiny outer surface; *vc.*, vertical canal.

only in unimportant details (*Palæoniscus elegans*; *Eurynotus crenatus*, text-fig. 198; *Elonichthys*, *Gonatodus*, Pl. XLV. fig. 15). They can be recognised at once in sections by the presence of a network of canals and a layer of cosmine underlying the laminæ of ganoine.

The scale of *Cheirolepis*, the structure of which is shown in Pl. XLV. fig. 13 and text-fig. 202, has all these characters well developed in spite of its small size and peculiar shape.

The remainder of the Actinopterygii, except the Teleostei, all appear to have the Lepidosteoid type of scale, with the peculiar tubules described above (p. 758).

The Protospondyli.—In the family Semionotidæ, I have examined *Semionotus kappfi*, *Lepidotus mantelli*, and *Dapedius* sp.; in the Pycnodontidæ, *Microdon* sp.; in the Eugnathidæ, *Eugnathus formosus* (Pl. XLVI. fig. 20); in the Pachycormidæ, *Pachycormus heterurus*; and *Ophiopsis* in the Macrosemiidæ. These genera display a remarkably uniform type of lepidosteoid scale. The scales of the Amiidæ (*Amia* and the extinct *Megalurus*) are so thin that little can be made out in sections beyond the fact that they are formed of laminæ and contain bone-cells, except in the topmost layer. However, a section of a cranial dermal bone of *Amia* shows the lepidosteoid tubules developed in the most perfect manner (Pl. XLVI. fig. 18). This observation is of some practical importance, as it may help us to determine the affinity of those fish in which the scales are degenerate or absent, but of which cranial plates can often be obtained*.

The Ætheospondyli.—Both the Aspidorhynchidæ and the Lepidosteidæ show the same characteristic structure; the genera examined being *Lepidosteus* (Pl. XLVI. fig. 16, and text-fig. 199), and *Aspidorhynchus* (fig. 19), already described by Williamson.

It is interesting to find that the scale of *Pholidophorus* also belongs to the Lepidosteoid type.

Summary.—From what has been said in the foregoing pages, it will be gathered that the scales of the Dipnoi and Teleostomi present very few distinct types of structure. That in fact only three distinct types exist: the cosmoid, the palæoniscoid, and the lepidosteoid. Certain other varieties are found, such as the Rhizodont and Dipnoan, which are probably to be derived from the cosmoid. The position of the Cœlacanth scale is at present difficult to determine: it may be a primitive form in which the denticles have not yet fused to a cosmine layer, as Williamson supposed; or it may be simply a degenerate cosmoid scale to the surface of which denticles have become attached.

Further, it appears that the structure of the scales is very uniform within the families, and that closely allied families usually have very similar scales. The cosmoid scale occurs in the extinct Osteolepidoti (Crossopterygii) and Dipnoi; but in no other group of fish. Similarly the ganoid scale occurs in the Teleostomi and never elsewhere. The palæoniscoid type is restricted to the Palæoniscidæ and their immediate allies; while the lepidosteoid type is universal among the Protospondyli, the Ætheospondyli, and the Pholidophoridæ, and not found in any other group as far as is known.

These different kinds of scales, then, are of great systematic value, and the position of a fish in any of the large divisions can

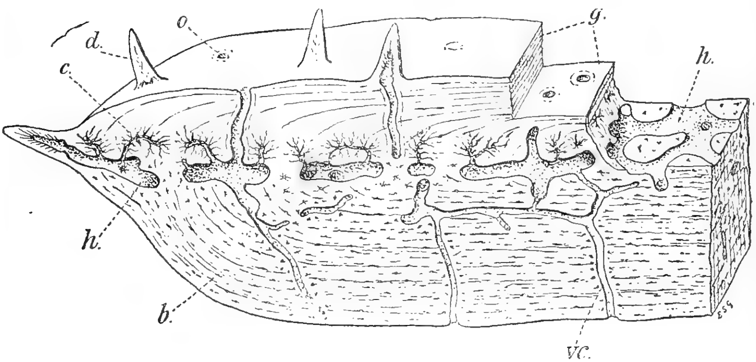
* Stewart has described similar bone in *Fistularia* (Cat. Coll. Surgeons).

at once be determined by an examination of its scale. Doubtless all the types have been evolved from some common ancestral scale, and numerous intermediate forms will be found, whose position will be difficult to assign; but so far the chief types remain remarkably distinct from each other. *

The Scale of POLYPTERUS.—Let us now apply our test to the scale of *Polypterus*. The Polypterini have always been placed among the so-called Crossopterygii ever since Huxley wrote his famous paper on the classification of Devonian fishes (**8**). I have elsewhere discussed in greater detail the affinities of *Polypterus* (**4**); and shall only mention here that, in a paper published some years ago (**4** *a*), my opinion has already been expressed that its relationship is rather with the Actinopterygii than with extinct "Crossopterygii."

The scale of *Polypterus* has been described by Agassiz (**1**), Leydig (**12**), and Hertwig (**7**). The last author especially

Text-fig. 203.



(From Lankester's 'Treatise on Zoology,' by permission of Messrs. A. & C. Black.)

Portion of a thick transverse section of the scale of *Polypterus bichir* Geoffr., much enlarged. *b.*, inner bony or isopedine layer; *c.*, canaliculi of the cosmine layer; *d.*, superficial denticle; *g.*, ganoine layer; *h.*, system of horizontal vascular canals; *o.*, opening of vertical canal on outer surface; *vc.*, vertical canal.

has contributed much information concerning the histological structure of the scale itself, and the denticles which become attached to its surface (p. 763).

A glance at text-fig. 203 will show at once that the scale of

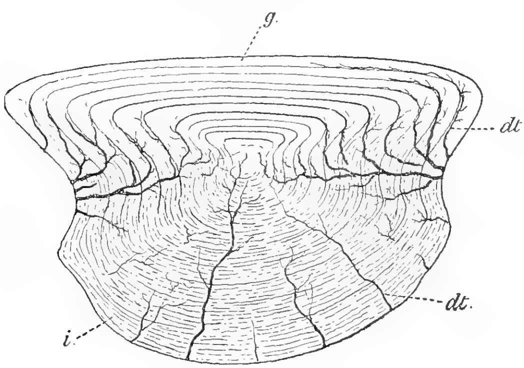
* Since this was written I have found a paper, which unfortunately escaped my notice, by Dr. H. Scupin ("Zur Histologie der Ganoidschuppen," Arch. f. Naturg. vol. lxii. 1896), in which the microscopic structure of fish-scales is dealt with.

Polypterus is of the ganoid type; and, moreover, that it belongs to the palæoniscoid variety. For in it can be seen not only the concentric layers of bone below and ganoine above, but also the intermediate horizontal network of vascular canals, and the cosmine-like layer supplied by narrow canals from which spring numberless dentinal tubules. No scale of this kind is known outside the Actinopterygii. The evidence is quite clear and definite: the scale is of the true ganoid type, and approaches that of the Palæoniscoid more closely than any other. Not for a moment is it asserted that *Polypterus* is a living Palæoniscid; but it is probably in the neighbourhood of this family that it will eventually find its place in the system of classification.

The Acanthodii.—The scales of the Acanthodii are of very uniform structure, usually in the form of a mosaic of very small closely fitting, thick, rhomboidal plates, set in oblique rows like the ganoid scales of a Teleostome.

They have always been compared to those of the Elasmobranchs, and are generally spoken of as modified denticles, in which the pulp-cavity has become reduced. Rohon (**18**), Reis (**16**), and

Text-fig. 204.



(From Lankester's 'Treatise on Zoology,' by permission of Messrs. A. & C. Black.)

Transverse section of the scale of *Acanthodes* sp.; L. Carboniferous, Edinburgh. *dt.*, branching canaliculi; *g.*, outer shiny layer; *i.*, inner more opaque layer.

Fritsch (**2**) have given descriptions of the scales of various Acanthodians.

The chief features of the structure of the scale of *Acanthodes* are shown in the semi-diagrammatic text-figure 204, and in fig. 21 (Pl. XLVI.), which represents a section taken parallel to the upper surface. It is at once clear that it differs radically from the placoid denticle in its mode of growth, which is by the addition of complete concentric layers, just as in a ganoid scale. Neither in this nor in any other species that I have examined, from Devonian, Carboniferous or Permian rocks, can I find the slightest trace of the small pulp-cavity the presence of which is asserted by Rohon, but denied by Reis. Nor does the structure of the scale seem to me to afford any evidence whatever of such a cavity having been present. Reis and others have already described dentinal tubules passing inwards from the periphery. These run in towards the centre, at right angles to the lines of growth, from all the circumference except the top; and are specially numerous about half way up the scale, where a slight constriction separates the upper from the lower region. Only a few tubules reach the middle, most of them stop short at varying distances from the edge.

The outer or upper region of the scale appears more dense than the lower; it is not pierced by tubules from above, but some of them penetrate far into the superficial laminæ from the sides No bone-cells are present.

The Acanthodian scale, with its concentric laminæ and upper ganoine-like layers, bears a striking resemblance to the ganoid scale of the Teleostome. Moreover, the distribution of the branching dentinal tubules is quite like that of the similar tubules of the lepidosteoid type of scale, excepting for their more extensive spreading on to the upper surface. There are no vascular canals, a fact which may be correlated with the small size of the scale.

Whatever may be the origin of the Acanthodian scale, there can be no doubt that it is built on a quite different plan from that of the placoid, and that it approaches most nearly to the lepidosteoid type. Fritsch (**2**) figures scales of *Traquairia* and *Protacanthodes* with a tooth-like process on the hinder edge; unfortunately he gives no information as to the histological structure of these scales, so that it cannot be determined whether the process represents a pointed extremity or a denticle fused on.

At present we know too little concerning the scales of the Acanthodii, to draw any conclusion from their structure as to the phylogeny of the group. But these scales should no longer be vaguely called modified denticles, and used as evidence of affinity with the Elasmobranchs.

List of References.

1. Agassiz, L.—Recherches sur les Poissons Fossiles. Neuchâtel, 1833–44.

2. Fritsch, A.—Fauna der Gaskohle. Prague, 1879–94.

3. Goodrich, E. S.—"On the Dermal Fin-Rays of Fishes." Quart. Jour. Micros. Sci. vol. xlvii., 1904.

4. Goodrich, E. S.—"On the Systematic Position of *Polypterus*." Brit. Assoc. Report, 1907.

4 *a*. Goodrich, E. S.—"On the Pelvic Girdle and Fin of *Eusthenopteron*." Quart. Jour. Micros. Sci. vol. xlv., 1901.

5. Günther, A.—"Description of *Ceratodus*." Phil. Trans. vol. clxi., 1871.
6. Hertwig, O.—"Ueber Bau u. Entwicklung der Placoidschuppen." Jena. Zeitschr. vol. viii., 1874.
7. Hertwig, O.—"Ueber das Hautskelet der Fische." Morph. Jahrb. vol. ii., 1876; vol. v., 1879; vol. vii., 1881.
8. Huxley, T.—"The Systematic Arrangement of the Fishes of the Devonian Epoch." Mem. Geol. Surv., Dec. 10, 1861.
9. Huxley, T.—"On *Cephalaspis* and *Pteraspis*." Quart. Jour. Geol. Soc. vol. xiv., 1858.
10. Klaatsch, H.—"Zur Morphologie der Fischschuppen." Morph. Jahrb. vol. xvi., 1891.
11. Lankester, E. R.—"The Cephalaspidæ." Mon. Palæont. Soc., 1868–70.
12. Leydig, Fr.—"Histologische Bemerkungen über den *Polypterus bichir*." Zeit. f. wiss. Zool. vol. v., 1853.
13. Nickerson, W. S.—"Development of the Scales of *Lepidosteus*." Bull. Mus. Comp. Zool. vol. xxiv., 1893.
14. Pander, C. H.—Die Placodermen des Devonischen Systems. St. Petersburg, 1857.
15. Pander, C. H.—Ueber die Ctenodipterinen d. Devonischen Systems. St. Petersburg, 1858.
16. Reis, O.—"*Acanthodes bronni*." Morph. Arbeiten, vol. vi.
17. Reissner, E.—"Ueber die Schuppen v. *Polypterus* u. *Lepidosteus*." Arch. f. Anat. u. Phys., 1859.
18. Rohon, J. V.—"Ueber fossile Fische v. oberen Jenissei," etc. Mém. Acad. St. Pétersb. vol. xxxvi., 1889, & vol. xli., 1893.
19. Rohon, J. V.—"Die Dendrodonten." Ibid.
20. Rohon, J. V.—*Holoptychius*-Schuppen." Bull. Acad. St. Pétersb. vol. ii., 1890.
21. Röse, C.—"Ueber d. v. Abänderungen der Hartgewebe." Anat. Anz. vol. xiv., 1898.
22. Tomes, C. S.—"The Enamel of Elasmobranch Fishes." Phil. Trans. B, vol. cxc., 1898.
23. Traquair, R. H.—"Report on Fossil Fishes." Trans. Roy. Soc. Edinb. vol. xxxix., 1899.
24. Traquair, R. H.—"On *Thelodus pagei*, Powrie." Ibid. vol. xxxix., 1898.
25. Wiedersheim.—"Dipnoerschuppen." Arch. f. mikr. Anat. vol. xviii., 1880.
26. Williamson, W. C.—"On the Microscopic Structure of the Scales &c." Phil. Trans. vol. cxl., 1849.
27. Williamson, W. C.—"Investigations into the Structure and Development of the Scales and Bones of Fishes." Phil. Trans. vol. cxli., 1850.
28. Woodward, A. Smith.—Brit. Mus. Cat. Fossil Fishes, vol. i., 1889.
29. Woodward, A. Smith.—"On a new Specimen of the Chimæroid Fish, *Myriacanthus paradoxus*." Quart. Jour. Geol. Soc. vol. lxii., 1906.

EXPLANATION OF PLATES XLIII.-XLVI.

SCALES OF FISH.

Reference Letters.

bc, bone-cell; *bt*, branching canaliculus; *cc*, branching cosmine canaliculus; *d*, denticle; *e*, enamel-like layer; *ed*, growing edge of scale; *g*, line marking growing edge at an earlier time; *gn*, ganoine; *hv*, horizontal vascular canal; *i*, inner bony laminæ of isopedine; *ir*, inner and older region; *ll*, inner laminated layer; *o*, outer ornament of ridges and spines; *oc*, outer cavity; *ol*, outermost or newest layer; *pc*, pulp-cavity; *r*, ridge; *sp*, spinelet on surface; *t*, tubercle; *tu*, tubule with branching inner end; *vc*, vascular cavity; *vch*, vascular chamber; *vl*, vascular layer; *vtc*, vertical vascular canal.

Plate XLIII.

Fig. 1. Enlarged outer view of scales on the head of *Thelodus*.
2. Similar view of scales on the tail of *Thelodus*.
3. Fragment of a plate of *Psammosteus paradoxus* Ag. Enlarged.
4. Vertical section of a plate of *Psammosteus arenatus* Ag. Enlarged, cam.
5. Section through the edge of a scale of *Osteolepis macrolepidotus* Ag. Enlarged, cam.

Plate XLIV.

Fig. 6. Section of a scale of *Eusthenopteron foordi* Wh. Enlarged, cam.
7. Section through the broken edge of a scale of *Rhizodus* sp. Enlarged, cam.
8. Similar section of a scale of *Rhizodus ornatus* Traq. Enlarged, cam.
9. Oblique view of surface of cleithrum of *Polypterus bichir* G. Enlarged.
Figs. 10 & 11. *Phaneropleuron curtum* Wh.; sections of scale. Enlarged, cam.
Fig. 12. Section of gular plate of *Cœlacanthus* sp. The outer cavities, *oc*, are covered over with a thin shiny layer. Enlarged, cam.

Plate XLV.

Fig. 13. Horizontal section, nearly parallel with the outer surface, of a scale of *Cheirolepis* sp. Enlarged, cam.
14. Surface views of the scale of *Rhizodus ornatus* Traq. A, Anterior edge of scale; B, posterior exposed region. Enlarged.
15. Outer region of sections of scale of *Gonatodus* sp. A, oblique: ganoine not shown. B & C, vertical to surface; B, towards centre of scale; C, at edge. Enlarged.

Plate XLVI.

Fig. 16. Fragment of bony layers of scale of *Lepidosteus osseus* L. Enlarged.
17. Central portion of vertical section of scale of *Heterolepidotus latus* Eg. Enlarged, cam.
18. Section through a cranial plate of *Amia calva*. Enlarged, cam.
19. Section through a scale of *Aspidorhynchus* sp. Enlarged, cam.
20. Section through the edge of a scale of *Eugnathus* sp. Enlarged, cam.
21. Section nearly parallel with the surface of a scale of *Acanthodes* sp. Enlarged, cam.

2. The Rudd Exploration of South Africa.—VIII. List of Mammals obtained by Mr. Grant at Beira. By Oldfield Thomas, F.R.S., and R. C. Wroughton, F.Z.S.

[Received July 18, 1907.]

Long as the region of Beira and the Pungwe River has been known as a paradise for sportsmen, no scientific collection of mammals appears ever to have been made there, and certainly our own National Museum has never received any specimens from the district. Consequently the present collection, obtained by Mr. Grant for the Rudd Exploration, is of very great value as filling in the geographical gap between Inhambane, whence came the magnificent series enumerated in our previous paper, and the better known regions of the Zambezi and Nyasaland.

The results, from the point of view of geographical distribution, are in many cases most curious and interesting, and show the necessity for such systematic explorations as this of Mr. Rudd's before we can consider our knowledge on the subject to be at all complete. For example, in the case of *Petrodromus* one would have supposed that the same form would occur as at Inhambane further southwards, since a closely allied one is found on the coast further north in East Africa. But instead a member of quite another group—*P. tetradactylus*, an inhabitant of the higher inland region from Nyasa to S. Rhodesia—here reaches the East coast area, and isolates the Inhambane species from its northern ally.

Then, again, the *Georychus* is much more closely allied to the Bechuanaland *G. lugardi* than to *G. darlingi* of Mashonaland, intermediate in geographical position.

There are evidently therefore very many interesting problems still to be determined about the geographical distribution of the species, and about the faunal areas into which the country should be divided.

Twenty-nine species are included in the present collection, represented by 129 specimens, all, as before, added to the National Museum by the generosity of Mr. C. D. Rudd.

The collection was made in two localities, the one just outside Beira, and the other, Masembeti, on the Railway 23 miles from that place.

Mr. Grant's report on the region is as follows:—

"The Beira District may briefly be described as low lying, flat country, with patches and stretches of forest alternating with open plains dotted with palmetto, bamboo brakes and ant-heaps, and with vleis and lakes in the lowest parts.

"In the wet season the whole country, except the higher forested portions, is one vast swamp and the vegetation is both thick and high.

"Natives are few and scattered, as there is little habitable veldt on which crops can be grown.

"The climate during the wet season is by no means healthy, and although the thermometer may not always record high temperature, it is generally sultry and muggy. Collecting work is difficult and the damp heat is most enervating.

"Throughout the trip the weather was warm, average temperature 86° in the shade. There was plenty of rain, especially during the latter half, which was undoubtedly bad for trapping work; this combined with the scarcity of mammals in the district, and the ravages of ants which completely destroyed numbers of trapped specimens, prevented the collection made from being larger.

"The scarcity of mammals, especially the smaller ones, is probably due to the annual flooding of the country, as numbers must be drowned out and killed during the rainy season."

1. CERCOPITHECUS PYGERYTHRUS Cuv.

♂. 1743, 1746, 1794. ♀. 1744, 1745, 1793. Beira.

It is worthy of record that no. 1746, a mere baby in arms, the son of no. 1744 (*teste* the Collector) has, above the usual white brow-streak, a sandy-coloured streak separated from the former by an indefinite black one; this effect is produced by the fact that the hairs immediately above the white face-streak are black with yellow tips.

"Native name, 'Shoku.'

"Fairly common in all the forest and seen in troops of from six to perhaps a dozen or fifteen.

"Extremely wary and at the least sign of danger hiding in the tops of the trees and on the upper sides of the larger branches, where it is impossible to detect them; they can sometimes be secured by lying in wait where a troop has been seen to thus disappear.

"Diurnal only, and living on the wild fruits and berries."

2. CERCOPITHECUS ALBOGULARIS BEIRENSIS Poc.
P. Z. S. 1907, p. 701.

♂. 1761, 1781. Beira.

A new form described by Mr. R. I. Pocock on these specimens, and therefore to be credited as one of the discoveries of the Rudd Expedition. No. 1761 is the type.

3. GALAGO GRANTI Thos. & Wrought.

♀. 1695, 1696. Beira.

Both specimens are quite young.

"Native name, 'Sfenge.'

"Apparently not common.

"Frequenting the forests and breeding and sleeping in the hollow trees."

4. EPOMOPHORUS CRYPTURUS Pet.

♂. 1685, 1686. ♀. 1687. Masembeti.

These specimens undoubtedly represent the *E. crypturus* of Peters, the type locality of which was Tette. Whether this name is a synonym of *E. gambianus* as stated by Dobson, may be left to be decided when the genus is again thoroughly overhauled.

"Native name, 'Igoshe.'

"Observed only in the bed of the Masembeti R., where these specimens were disturbed from the overhanging trees, and shot.

"According to the natives it is common, and is constantly seen by them when the 'cachou' trees are in fruit."

5. Glauconycteris papilio Thos.

♀. 1777. Beira.

The present specimen in its white head and belly recalls very strongly the colour pattern of *G. variegatus*; it is, however, immature, and we think it safer at present to rank it, as we did the specimens from Inhambane (P. Z. S. 1907), with *G. papilio*.

"Native name, 'Sinyegetongi.'

"The specimen was the only one observed."

6. Scotophilus nigrita Schreb.

♂. 1773. ♀. 1769, 1770. Beira.

3 specimens in al.

The specimens are all immature; they possibly represent Peters's *Nycticejus planirostris*, and are apparently identical with the smaller form received from Inhambane.

"Native name, 'Sinygetongi.'

"This species was observed only on two or three occasions and is apparently rare near Beira."

7. Petrodromus tetradactylus Pet.

♂. 1772, 1790. ♀. 1702, 1723. Beira.

Peters's recorded localities were "Tette, Sena, Boror," and identical or very closely allied forms are found in Mashonaland, N. Rhodesia and Nyasaland. It is curious that the species at Inhambane, on the coast to the south of Beira, is a totally distinct species allied to *P. sultan* from Mombasa.

"Native name, 'Wierare.'

"Decidedly uncommon in the district.

"Inhabits the forests, especially the thicker parts where it has regular runs, in which these specimens were trapped.

"Both nocturnal and diurnal."

8. Crocidura sp.

♂. 1694, 1725, 1729, 1747. Beira.

Though much darker and slightly larger, these probably represent Peters's *C. hirta* from Tette.

"Native name, 'Majaje.'

"Apparently uncommon; inhabiting thick vegetation both in the forest and on the borders of vleis, lakes and streams."

9. Felis serval Schreb.

♂. 1749. Beira.

"Native name, 'Nsonsi.'

"Not uncommon; the spoor is often observed along the native footpaths.

"It is a rather wary animal and not easy to trap.

"Strictly nocturnal and often visiting the kraals at night for the chickens, &c."

10. Genetta sp.

♀. 1758. Beira.

Belongs to the group with a well marked internal cusp on p^3. May be *G. zambesiana* of Matschie, the type locality of which is given as "Boror, Nyassa."

"Native name, 'Mulimba.'

"Spoor of this species was seldom seen, showing that it cannot be plentiful.

"Found principally along the valleys of the streams and near vleis; also within the forest.

"Nocturnal in habits."

11. Mungos galera Erxleb.

♂. 1765. ♀. 1780. Beira.

"Native name, 'Slangane' or 'Ivugo.'

"Not uncommon in the low-lying parts, such as the vleis and the borders of lakes and streams.

"Nocturnal only."

12. Crossarchus fasciatus Desm.

♂. 1683, 1684. Masembeti.

"Native name, 'Madenbo.'

"Fairly common, especially at the River Masembeti; observed in parties of a dozen or more.

"It inhabits the forest where it is not easy to secure, more often being heard than seen, scampering away to the thick undergrowth.

"Diurnal only, living principally on coleopterous insects."

13. Funisciurus mutabilis Pet.

♂. 1754, 1756, 1764, 1774, 1782. ♀. 1716, 1748, 1750, 1791. Beira.

♂. 1679, 1680. Masembeti.

"Native name, 'Shindi.'

"Quite one of the commonest animals near Beira, and frequenting all the forests, especially the dead trees left in the native clearings, in the holes of which they apparently sleep and breed.

"Generally observed in pairs and sometimes family parties, very active and somewhat shy, hiding by laying itself along the upper side of a branch, where it is very difficult to detect them.

"The alarm note is a bird-like chatter, and their food apparently consists of the fruit and berries of the forest trees.

"Strictly diurnal."

14. Funisciurus sponsus Thos. & Wrought.

♀. 1789. Beira.

Quite similar to specimens from the type locality.

"Native name, 'Shindi.'

"This species is decidedly rare on the Beira side of the Pungwe and was only observed on two occasions, both times in the same small stretch of forest.

"Only four were observed altogether, three when the specimen sent was secured and one on another occasion.

"It was excessively wild, and in the thick forest difficult to observe or shoot."

15. Tatera lobengulæ de Wint.

♂. 1697, 1699, 1783. ♀. 1701, 1707, 1784. Beira.

These specimens are of the long-tailed type characteristic of Africa south of the Zambezi. Peters's *Meriones leucogaster*, which comes from the coast immediately north of the Zambezi, has a short tail. It is interesting to note that the Beira form is practically identical with that of Mashonaland, and totally distinct from that from the very much nearer Quillimane District, although the climatic conditions of the latter are practically the same as those of Beira.

"Native name, 'Banye.'

"Not common, inhabiting principally clearings and native lands, where in habits it is similar to its congeners in other parts of South Africa."

16. Pelomys fallax Pet.

♂. 1693, 1776. Beira.

♂. 1688. Masembeti.

These specimens show clearly that the length of the tail in proportion to the head and body varies considerably in this species; in all three cases, however, it is longer than the head and body combined. Peters records a length considerably shorter than the head and body and at the same time shorter than in any of these individuals; his figure, however, does not support the text, for in it the tail is almost though not quite equal to the head and body. In all other respects these specimens answer to the description of *P. fallax*, the type locality of which was Boror.

"Native name, 'Ibusi.'

"Not common. In habits it exactly resembles *Otomys irroratus*, like that species inhabiting the vleis, the banks of rivers and lakes and all damp places, also sometimes the long grass on the outskirts of the forest.

"No signs of nest or hole were, however, observed.

"Strictly diurnal and a vegetarian."

17. Arvicanthis dorsalis Sm.

♂. 1700. ♀. 1708, 1721, 1753. Beira.

"Native name, 'Ntanu.'

"Fairly common both in the forest and in the open country.

"Exactly similar in habits to its congener in Inhambane and elsewhere."

18. Mus chrysophilus de Wint.

♂. 1704, 1730, 1742, 1752. ♀. 1719, 1734. Beira.

"Native name, 'Banye.'

"Not common: in habits similar to its congeners in other parts of South Africa."

19. Mus sp. (multimammate).

♂. 1720, 1760, 1771, 1788. ♀. 1762, 1763. Beira.

"Native name, 'Shikwi.'

"Common everywhere, especially near native lands and kraals.

"Habits similar to those of the species in other parts of South Africa."

20. Cricetomys gambianus adventor Thos. & Wrought.

♂. 1791. Beira.

A young individual.

"Native name, 'Wipe.'

"Apparently scarce, as the specimen sent was the only one seen and I was unable to find any of their burrows."

21. Acomys selousi de Wint.

♀. 1678. Masembeti.

♂. 1710, 1728, 1737, 1759, 1768, 1785. ♀. 1706, 1740, 1741, 1766. Beira.

Three in al. Beira.

"Native name, 'Mdondaundo.'

"Very common everywhere both in the forest, the cane-brake, and the long grass in the vleis."

22. Saccostomus campestris Pet.

♂. 1727, 1786. Beira.

"Native name, 'Iwite.'

"Not uncommon in and around old or cultivated lands.

"Nocturnal and a vegetarian."

23. Saccostomus mashonæ de Wint.

♂. 1767. ♀. 1724. Beira.

24. Leggada minutoides A. Sm.

♂. 1757. ♀. 1711, 1733. Beira.

These specimens almost certainly represent the *Mus minimus* of Peters from Tette, Buio, &c.

25. Georychus beiræ, sp. n.

♂. 1709, 1712, 1713, 1717, 1795. ♀. 1714, 1731.

A *Georychus* about the size of *G. lugardi*, with a white frontal spot.

Size only very slightly smaller than *G. lugardi.*

Fur short (4–5 mm.) and soft.

General colour above between "ecru drab" and "drab-grey"; the hairs "slate-grey" at their bases with fawn-coloured tips. A white mark on vertex about half an inch in diameter, varying in shape individually, but generally an irregular pentagon; not produced backwards on to the neck. Colour below the same as above, but the fawn tips of the hairs less conspicuous.

Skull but slightly smaller than that of *G. lugardi* at the same age, but slighter; premaxillaries at the base of incisors distinctly narrower; nasals somewhat longer; posterior premaxillary process not meeting or even nearly meeting behind the nasals as in *G. lugardi.*

Dimensions of the type:—

Head and body 155 mm.; tail 14; hind-foot 25; ear 5.

Skull—greatest length 40; basilar length 33; greatest breadth 28; breadth across postorbital processes 12; across base of incisors 7·5; upper molar row 6·5; diastema 12·5.

Hab. Beira, Portuguese East Africa.

Type. Adult male. B.M. no. 7.6.2.98. Original number 1713. Collected by C. H. B. Grant, 28th Nov., 1906.

Mr. Grant obtained a fine series of this species (seven specimens). It is at once distinguishable from *G. darlingi,* which it resembles in colour pattern, by its much larger size; from *G. lugardi* (with which it agrees in size and general colour pattern) it may be separated by its frontal white patch, which is sharply limited to the crown, while in that species it tends to stretch backwards as a median white line on to the neck and shoulders. Besides the skull characters noted above, it may be added that the lambdoid crest makes a reentering angle where it meets the sagittal, while in *G. lugardi* it is a straight line at right angles to the long axis of the skull.

"Native name, 'Fungi.'

"Common and forming regular runs and mounds.

"In captivity they show curious *Mus*-like propensities in their method of feeding, sitting up on their haunches and holding the food in the fore paws as do the rats and mice.

"On the surface of the ground their movements are slow and undecided.

"Apparently strictly vegetarian."

26. Thryonomys swinderenianus Temm.

♂. 1739.

"Native name, 'Tishengi.'

"Common in all thick vegetation bordering the vleis and lakes in the open lands, and edges of forest and lands.

"Very difficult, however, to secure specimens, especially during the wet season when the vegetation is rank and high.

"A vegetarian and probably chiefly nocturnal."

27. Cervicapra arundinum Bodd.

♂. 1691, 1692. Masembeti.

"Native name, Isawy.'

"Not by any means common.

"Inhabits the open plains, especially the long grass bordering the lakes and vleis.

"Here the Reed-Buck is unusually wild and difficult of approach."

28. Cephalophus grimmi L.

♂. 1778, 1787. Masembeti.

"Native name, 'Nkwenkwi.'

"Decidedly scarce in the district, only some half-dozen were seen during the trip.

"The natives say that this country is too damp for it, and it is quite possible this is one of the causes of its scarcity.

"Also, according to them, all the Duikers near Beira are of the same remarkable fawn coloration as the two specimens secured.

"It lies up in the forest, feeding in the open plains at night."

29. Cephalophus hecki Matsch.

♂. 1779. Masembeti.

This is a pale-coloured animal with a dark median dorsal area, very different from the more southern *C. monticola*. It seems to possess all the characters attributed by Prof. Matschie to his *C. hecki*.

"Native name, 'Ngudo' or 'Sikwi.'

"Scarce near Beira, slightly more common at the Masembeti River.

"Found exclusively in the forest; in habits is apparently similar to its congener in Zululand and the Knysna."

3. Notes on Two African Mammals. By R. Lydekker.

[Received October 20, 1907.]

(Text-figure 205.)

The Cameruns Elephant.

Since my paper on the ears of African Elephants * was published, I have learnt that the young living elephant from the hinterland of the South Cameruns upon which Dr. Matschie founded *Elephas africanus cyclotis* is figured in a work by Dr. L. Heck entitled 'Lebende Bilder aus dem Reiche der Tiere,' and published in Berlin in 1899. The ear is well shown in Dr. Heck's plate (No. 146), which is reproduced from a photograph, and appears to have a more regularly curved margin than the ear from Congo

* Proc. Zool. Soc. London, 1907, pp. 380 *et seq.*

territory shown in fig. 111 of my paper, and provisionally referred to the same race as the Cameruns Elephant. Now that I have seen the photograph (to say nothing of the original) of the latter, I have little doubt that the Congo Elephant is distinct—an opinion shared by Dr. Matschie. Unless, then, it be identical with *E. a. albertensis*, the name *E. a. cottoni*, already suggested in my original paper, may be adopted for the Congo Elephant, although I am unable to define its characteristics.

I may also refer to another point which has been brought to my notice since the publication of the Elephant paper, namely that the head represented in fig. 112 was obtained only a few miles away from the spot where the type of *E. a. selousi*, fig. 108, was killed. The Duke of Westminster's Elephant must therefore belong to the last-named race. The mistake is largely due to the fact that when first writing the paper I was misinformed as to the locality of the type of *E. a. selousi*. It follows that the alleged inflection of the lappet of the ear in the latter is a feature of no importance; its presence or absence depending apparently upon the way in which the ear is mounted.

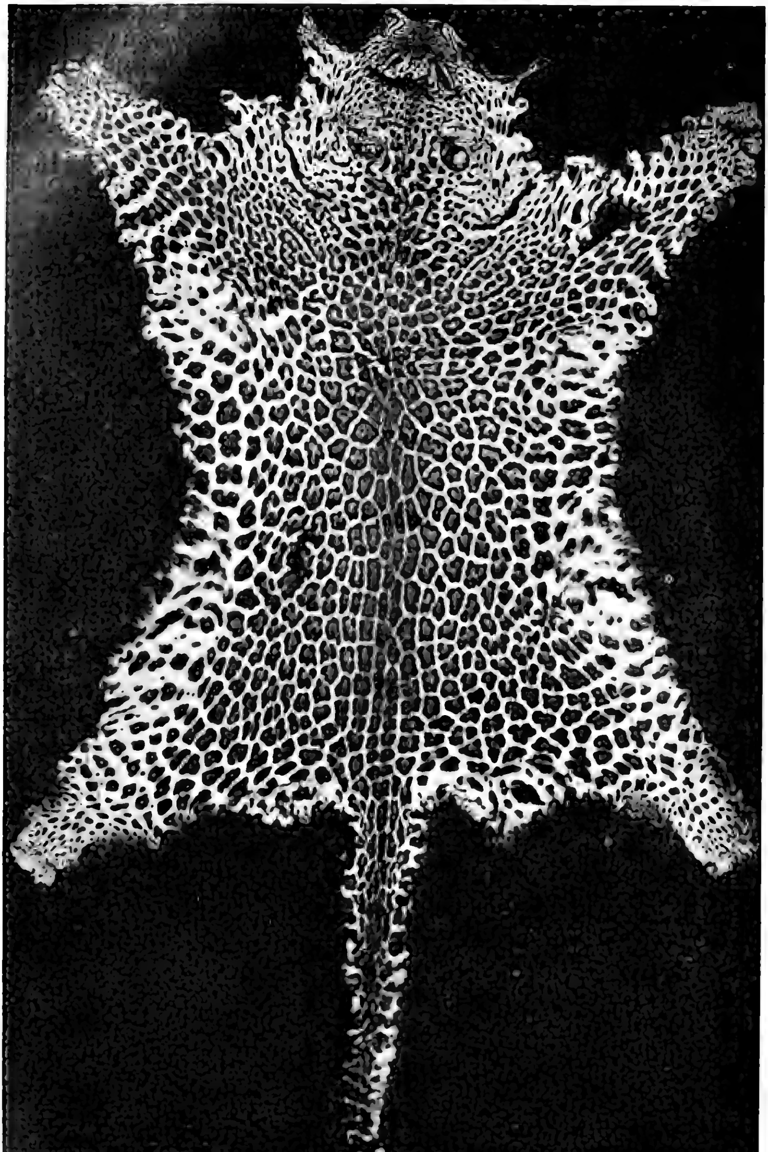
The Uganda Leopard.

The skin now exhibited (text-fig. 205), which was sent home from Uganda by Mr. Stanley C. Tomkins, is quite different in pattern from any other African leopard-skin that has hitherto come under my notice, and is certainly racially distinct from the ordinary small-spotted Leopard, of which, according to Mr. R. I. Pocock (Proc. Zool. Soc. 1907, pp. 675, 676), the West African *Felis pardus leopardus* is the typical representative. In addition to its colour-pattern, the Uganda skin is remarkable for the relative shortness of the limbs and tail; the length of the latter falling considerably short of half that of the head and body. Mr. Tomkins assures me that the tail is entire.

As regards pattern, the spots on the head are small and solid, and there is also the usual patch of larger solid spots on the withers, but with these exceptions and the occurrence of a double row of large oblong spots near the root of the tail, which seems quite peculiar to this form, the whole of the markings on the upper-parts take the form of large rosettes. These are frequently more or less completely closed, and often show one or two small solid spots in the enclosed area, which is darker than the general ground-colour. The latter gradually lightens from pale rufous fawn on the middle line of the back, to white on the under-parts, where, as on the limbs, the spots are very large and more or less completely solid. The point of resemblance to the ordinary small-spotted African leopards is the narrowness of the network of light lines.

A large-spotted Leopard, *Felis leopardus suahelicus*, has been described by Dr. O. Neumann (Zool. Jahrb., Syst. vol. xiii. p. 551, 1900), of which Uganda is one of the localities. No mention is,

Text-fig. 205.



A Leopard-skin from Uganda.

indeed, made in the description of *F. pardus suahelica*, as this large-spotted race should be called, of the occurrence of spots within the rosettes, which form such a marked feature in the skin sent by Mr. Tomkins. This I take to be a jaguar-like feature, although, except as regards their relative large size and completeness, the rosettes are not specially jaguar-like. Mr. Pocock (*op. cit.*) has already directed attention to jaguar-like Asiatic Leopards; and if I am right in my interpretation of the markings of the present specimen, we have now evidence of a resemblance to the American species in an African Leopard.

In addition to the above, a Leopard from Mount Ruwenzori has been recently described by Prof. L. Camerano * as *Felis pardus ruwenzorii*. This also seems to be a large-spotted form; and it is difficult to see how it can be separated from *F. p. suahelica*, at all events till we have a fuller description of the type specimen of the latter. The ground-colour, judging from the description, appears, however, to be darker than in the specimen now exhibited.

I certainly cannot affirm that the skin sent home by Mr. Tomkins is not referable to *F. p. suahelica*. If, however, the Leopard from German East Africa shown in plate 180 of Dr. Heck's above-cited work be the type of *suahelica*, then the specimen before us may possibly be distinct.

The locality where the Leopard-skin was obtained is Gomba. The specimen, I am pleased to be able to add, has been presented by Mr. Stanley Tomkins to the British Museum.

4. On the Feeding of Reptiles in Captivity. With Observations on the Fear of Snakes by other Vertebrates. By P. Chalmers Mitchell, D.Sc., LL.D., F.R.S., Secretary of the Society, and R. I. Pocock, F.L.S., Superintendent of the Gardens.

[Received November 12, 1907.]

For a number of years it has been the practice in the Society's Gardens to feed snakes in captivity on dead animals wherever possible. The feeding has taken place weekly on Fridays after the Reptile House has been closed to visitors, and has been part of the duty of our extremely competent keeper of the reptiles, J. Tyrrell, who has great experience and an unusual facility in handling reptiles and interpreting their wants. One or other of us has from time to time been present at the feeding, but we desired to make observations over a continuous period, and accordingly one or both of us have been present on all occasions when the snakes have been fed between the beginning of May

* Boll. Mus. Zool. Torino, xxi. 1906, No. 343, p. 1.

and the end of October 1907. We chose the summer months, as even in a House artificially heated all snakes feed less readily and some of them not at all during the winter months.

General Observations.

All our remarks under this heading relate to animals which have been killed before being offered to the snakes. Movements of the prey are movements that we have caused by various means, by throwing the animals in suddenly, by wriggling them with wooden forceps or attached twine, and so forth. We have not noticed any difference in the readiness of the snakes to take food if the animals were freshly killed, warm, or bleeding, or if they had been dead for some time; and it is to be noticed that in many cases the prey was not actually taken until night, long after it had been introduced; this was particularly the case when Pythons took large animals such as goats.

For the present purpose snakes may be divided into four groups:—Pythons; Non-poisonous Colubrines; Poisonous Colubrines; Vipers.

Pythons.—Pythons and Anacondas generally show their readiness to feed by special restlessness and activity; they move about restlessly, Pythons often leaving their tanks completely and Anacondas stretching part of the body out of the water; they become specially alert when they hear movements in the passage behind their cages, or when the back-doors are moved; in the words of the keeper, "they are asking for food." But this is not invariable; sometimes a Python will take no notice when the prey is thrown in or when it is moved in front of it or dangled over it, and yet later on it will take it. If the snake is eager, it makes a sudden dart at the prey, striking at no special part of the body and seizing and retaining hold with a violent bite. An Anaconda taking hold of a duck in this way almost at the same moment surrounds it with one or two tight coils and takes it under water. A Python without letting go throws a coil over it, holding it down; if the prey is of small size and motionless there is no attempt to wind the body round it, but if it is bulky or moves more coils are pressed over or round it. There appears, however, to be no special attempt to crush the prey, to suffocate it, or to break its bones. The amount of pressure or constriction exerted is, so to speak, a reflex action directly proportioned to the struggles or size of the prey. After some time, during which an originally living prey would have been suffocated, or in the case of the Anaconda drowned, the snake usually lets go its hold. It then passes its head all round the prey, playing over it with its forked tongue, and by some means other than that of sight, as the choice is made equally in the dark, perhaps by the sense of touch in the muzzle or lips, selects the head of the carcase to begin the process of swallowing. A snake that comes across a dead body behaves in the same way. We have never seen a snake of the Python group make a mistake in its selection of the head and snout to begin on, and it is plain that the lie of hairs, or feathers, the position of horns and the general shape of the body of vertebrates, justify the snake in its choice. Occasionally in the process of swallowing, a coil of the snake appears to push against the posterior end of the prey, but this appears to be simply a means of holding the prey steadily. The mechanical process is one in which the snake pushes itself outside the carcase; it gives a huge gulp and fixes its teeth as far back over the body as is possible, and then slowly, in big wrinkles, pushes a portion of its mouth and gullet forwards; then with another gulp gets its teeth fixed still a little further on to the prey and repeats the forward bringing up of the body, the general appearance of the motion being similar to that of the progression of an earthworm. Frequently, when the prey is large, the process of ingestion is not straightforwards, the jaws being moved first to one side and then to the other, alternately. Whilst swallowing is taking place there is a certain amount of salivation, but the discharge is not so copious as in poisonous snakes, and no saliva is shed on the prey before the swallowing begins. A carcase wetted all over is one that has been swallowed and afterwards disgorged.

So far as the quantity of food taken by Pythons in the course of the year is concerned, our experience differs considerably from that of Mr. H. N. Ridley, who, writing of the specimens in the Botanical Gardens, Singapore *, says:—"Small-sized Pythons usually feed once a month. The large ones over 20 feet long usually once in from six to nine months. One which was about 22 feet long, not long after it was brought in, passed the remains of a deer. It fed again some time later on three chickens, and remained without food for six months, when it passed the remains of the fowls and then ate a good-sized pariah dog, which lasted it for nine months."

Non-poisonous Colubrine Snakes.—Such snakes, e.g. *Boodon lineatus*, *Spilotes corais*, behave very much like pythons in feeding. They seize the prey with a straightforward dart of the head and then, if it is of large size or moving, either lie upon it or partially twist round it to hold it steady. They then select the anterior end and begin to swallow it. If, however, the prey is of small size and easily swallowed, they take it straight away in the fashion of Cobras and Viperine snakes.

Poisonous Colubrine Snakes.—Our snakes in this category (Cobras) very seldom strike at dead food that is thrown to them. When the door of the cage is opened, they fix their attention on the keeper, and, if lively, stand up with the hood raised, watching him. They take dead food readily, swallowing it in the fashion of Viperine snakes, never being seen to lie partially over it or to coil round it as is done by non-poisonous Colubrines occasionally, and Pythons habitually.

* Journ. Straits Branch R. A. Soc. no. 46, p. 189 (1906).

Poisonous Viperine Snakes.—Puff-adders, Copperheads, and species of *Lachesis* very often strike dead food when it is thrown to them, or when it is dangled in front of them or otherwise made to simulate life. They strike and let go their hold in a moment, the strike and disengagement being equally rapid. If the prey is very small they occasionally swallow it at once. When swallowing dead food that they have struck and released, or, as frequently happened, that they had never attempted to strike, they are not infrequently indifferent to the direction of the hair, but begin to swallow from the anterior or posterior end of the prey with equal readiness. Salivation appeared to us to be much more copious than in the case of the Pythons.

It is possible that the rapid disengagement of the fangs after striking may be a protective instinct by which the snake avoids being bitten or clawed by its prey before the poison has taken effect.

Detailed Record.

In all these cases the prey was killed before being offered to the reptile.

Reticulated Python (*Python reticulatus*).

(East Indies.) *

a. A large specimen, judged to be 24 feet in length, deposited in Aug. 1898. This Python was thin and lethargic in the early part of the summer and could not be induced to feed until August. But having once made a start, he continued to feed till November while the warm weather lasted, and took in all six goats and six ducks. He never showed keenness, however; and was never seen to seize his prey with the swift head-drive characteristic of specimens *c* and *d*, even when it was made to move. He always approached it slowly and took it in a leisurely and deliberate manner, after searching for the head in the way described above. Quite commonly he refused to touch it before nightfall.

b. Of two large specimens deposited in April 1907, one did not feed before being returned to the depositor in September. The other refused all food through June and July but began to feed in August. He rapidly picked up in condition and on October 25th took one duck, one rabbit, one guinea-pig, and two pigeons; and on November 1st swallowed a small goat.

c. Presented in Oct. 1898. Always lively and vicious, this snake fed with great regularity all through June, July, and August, only refusing food on one or two occasions when sick for shedding. Rabbits were usually given; but he took a kid one day, although not with eagerness.

* Brackets indicate that the exact locality of the particular specimen is unknown.

d. Presented in Sept. 1890. Although not so active and eager as the last, this Python usually took one rabbit a week, from June to September. A kid offered to him on one occasion was rejected; but a rabbit was instantly seized.

e. This specimen, presented in 1894 and kept in the same cage as the last, was in poor condition at the beginning of the summer and was a bad feeder all the season, only now and again taking rabbits after they had been left some little time in the cage. The second time of feeding, he swallowed two rabbits within a few minutes of each other. For five days he lay as if dead, and then disgorged them, the swelling caused by the two rabbits showing no signs of lessening during that period.

DIAMOND PYTHON (*Python spilotes*).

(Australia.)

Although no experiments were made upon a representative of this species, it is worth recording that an example deposited for a short time in the Gardens early in the year had been trained, we were told, to take dead rats from its owner's hand.

COMMON BOA (*Boa constrictor*).

(S. America.)

A specimen about six feet long, deposited during the month of August, took rats with avidity, swallowing five one after the other at the first trial. This snake had previously been fed upon living rats, as was ascertained from its owner, who, influenced by the popular belief, had never considered it worth while to offer it dead animals.

ANACONDA (*Eunectes murinus*).

Para.

Presented in Aug. 1902. This snake began to feed at the end of June and continued to take ducks at irregular intervals until the end of August, being very uncertain in his appetite. He always fed in the water. Sometimes he required a good deal of persuasion in the way of moving the duck at the surface. At other times he would seize it from the keeper's hand the moment it appeared over the edge of the tank.

COOKE'S TREE-BOA (*Corallus cookii*).

(Tropical America.)

Some newly imported specimens, deposited in the Gardens in the summer in very poor condition, would not take the food, and died after a few weeks without showing any signs at any time of recovering health.

COMMON GRASS SNAKE (*Tropidonotus natrix*).

(England.)

The three specimens of this species in the Society's collection fed at irregular intervals upon young gudgeon and dace. They appeared to find the fish by scent.

VIPERINE SNAKE (*Tropidonotus viperinus*).

(North Africa.)

Like the specimens of *T. natrix*, one example of *T. viperinus* fed upon small fish.

MOCASSIN SNAKE (*Tropidonotus fasciatus*).

(North America.)

One specimen. Fed readily upon gudgeon, taking them without hesitation from the keeper's hand.

CORAIS SNAKE (*Spilotes corais*).

(S. America.)

Of two specimens of a black variety identified as variety *couperi* and presented in Oct. 1906, one or the other fed upon young rats nearly every week, the number taken at a meal varying from one to four. Another specimen, perhaps belonging to the variety *melanura*, which was deposited in September of this year, also took rats and sparrows as well; the keeper tells us that a specimen formerly exhibited in the house would eat pieces of raw meat off a plate. Sometimes these snakes made use of a loop of the body to hold their food to the ground; but usually they swallowed it without that aid after the manner of Viperine Snakes. They were never seen to coil round it.

LINEATED BOODON (*Boodon lineatus*).

(S. Africa.)

A specimen of this species fed, but by no means regularly every week, upon small rats and mice. Upon one occasion he was seen to coil once round the carcase like a Python.

CORN SNAKE (*Coluber guttatus*).

(N. America.)

ANNULATED SNAKE (*Leptodira annulata*).

(S. America.)

ÆSCULAPIAN SNAKE (*Coluber longissimus*).

(Europe.)

RUFESCENT SNAKE (*Leptodira hotambœia*).

(S. Africa.)

The specimens of these four species took fish. The Æsculapian Snake would also eat mice; but the Annulated Snake on one occasion took a gudgeon after refusing a dead mouse.

Indian Cobra (*Naia tripudians*).

(India.)

Although suffering from a tumour behind the head, from which it died in September, this snake took a rat on one occasion.

Yellow Cobra (*Naia flava*).

(S. Africa.)

This snake took one or two young rats nearly regularly every week.

Black-and-White Cobra (*Naia melanoleuca*).

(W. Africa.)

Like the Yellow Cobra, this snake, deposited in Aug. 1905, fed nearly every week, except when quiescent before shedding his skin. He took from one to four rats at a meal.

Puff Adder (*Bitis arietans*).

(S. Africa.)

Of this species the Society possesses a very large number of specimens, mostly presented during the course of the present year by Mr. A. W. Guthrie, C.M.Z.S., of Port Elizabeth. Owing to the necessity of keeping a number together in one cage, it is quite impossible for us to state that all of them took dead rats. Some five or six rats, however, were placed in each cage every week, and were for the most part eaten, sometimes at once, sometimes in the course of the night. A large specimen, deposited in May 1906, and kept in a cage by himself, took small rabbits, guinea-pigs or rats fairly regularly throughout the summer.

Copper Head (*Ancistrodon contortrix*).

(N. America).

Three specimens of this species, received in 1900 and 1901, have fed regularly on rats throughout the summer and autumn.

An example of an allied species, the Water-Viper (*Ancistrodon piscivorus*), that was formerly exhibited in the Zoological Gardens at Clifton, was fed upon pieces of raw meat, which it took just as readily as the Society's specimens take rats or mice.

Fer-de-Lance (*Lachesis lanceolata*).

(S. America.)

The three snakes of this species possessed by the Society are the survivors of a brood of about twenty purchased in Dec. 1905. They were fed at first upon small fish. They now take mice and small rats, and are the best feeding snakes in the collection. They have scarcely refused food once through the summer and autumn, and raise their heads in expectation as soon as they hear the doors of the adjoining cages being opened.

Some additional specimens deposited in September of this year refused all food for the first five weeks. A large one, however, took a half-grown rabbit at the beginning of November.

CROSSED VIPER (*Lachesis alternata*).
(S. America.)

Three specimens, deposited in August 1905, have fed almost as regularly through the season as the specimens of Fer-de-Lance. When frightened by the opening of the door of the cage, they sometimes make a rustling sound, quite audible through the glass, by rapidly vibrating the end of the tail against the sides of the cage. In their natural haunts no doubt the same sound would be produced by the shaking of the tail in the herbage.

We also found that Glass Snakes (*Ophisaurus apus*), one of the Lacertilia, *Hatteria* and some of the larger Frogs, such as the Bull-Frog, readily took dead mice and small rats. The frogs invariably hopped into the water with their prey immediately after seizing it, as if with the object of drowning a living animal as quickly as possible.

SUMMARY OF RECORD.

It will be noticed that throughout the many months over which our observations extended, our snakes fed with great regularity and at much shorter intervals than is generally reported, especially in the case of the Pythons. It is also noteworthy that we found no species of snake, poisonous or non-poisonous, that would not take dead food, and that it was unnecessary to give live food to any individual snake. In these respects, however, other observers of at least equal experimental enthusiasm, have had a smaller measure of success in inducing serpents to take dead prey. Private persons who have kept snakes and Directors of Zoological Gardens in Europe and America have spoken to us of getting only one snake in four to take dead food, of poisonous snakes that will never take dead food, and so forth. We set it down, therefore, not as a matter of scientific fact that all snakes can be persuaded to this non-natural form of diet, but as one of some interest that with the large collection in the Society's Gardens, we have been and hope to continue to be more uniformly successful in this mode of feeding reptiles than have been the owners of any other public or private collections with the exact details of which we are acquainted.

EMOTIONAL ATTITUDE OF OTHER ANIMALS TO SNAKES.

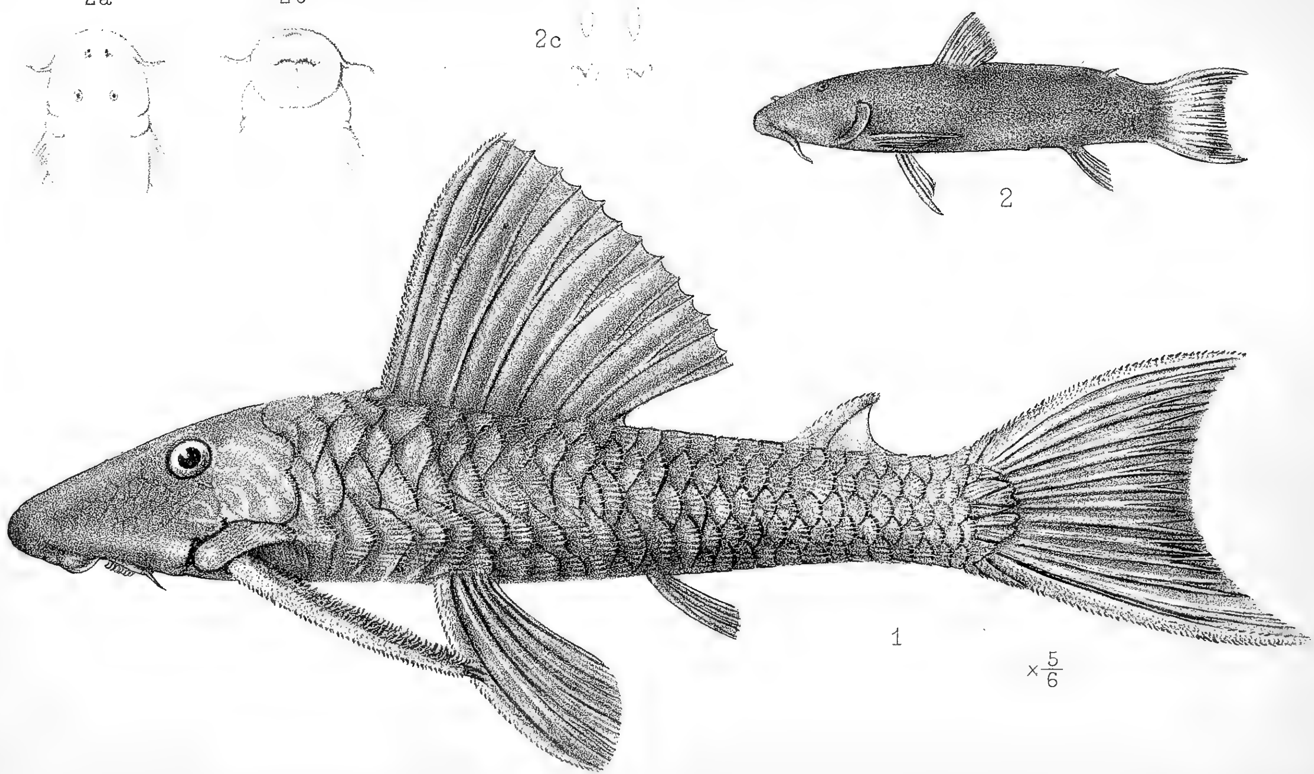
In the course of our own observations and experiments at the Society's Gardens and elsewhere, we have satisfied ourselves as to certain facts regarding the psychical effect of snakes on other animals, facts partly known to those who have had an opportunity of observing them, but not yet matters of common knowledge. In the first place, there is no such thing as a power of fascination possessed by snakes. In the vast majority of cases there is not even a pretext for imagining the existence of such a power. A good many animals, however, are inquisitive, and this in the case of many small and feeble creatures, such as the smaller birds and mammals, is associated with the power of attention. If a movement is sudden or noisy, they may start off at once; if it is slow, silent, and stealthy, they remain motionless but intensely watchful. If a snake is quick enough, it may secure its prey in that brief moment of motionless watchfulness, but a human hand slowly and carefully advanced has just as much power of fascination.

The second point on which we have been able to satisfy ourselves is that, except in the case of one group, animals have no specific fear of serpents. The vast majority of animals, including of course frogs, rats and mice, guinea-pigs, rabbits, ruminants, and birds, are totally indifferent to their presence, and even when a snake approaches them directly avoid it, just as they would avoid a stick thrust at them. In the case of such animals, the problem involved in giving them alive to snakes is no more than whether they are killed more painlessly by snakes or by human beings. In their recognition and fear of snakes, however, the Primates are in marked contrast to all other animals. Many naturalists have recorded that monkeys display an instinctive fear of snakes, and we have made a number of experiments on this point, displaying live and active snakes, such as the brightly coloured Corn Snake, a Tree-Boa, and a small Reticulated Python, to the Monkeys in the Society's Collection. We assumed that it was unnecessary to select poisonous snakes, as probably monkeys, like most savages and many civilised persons, would make no distinction between poisonous and harmless snakes. We wish first to record the extremely interesting fact that Lemurs differ markedly from true Primates, inasmuch as they exhibit no fear of snakes whatever. It was most curious to notice how, when we approached adjoining cages, the one with lemurs the other with monkeys, carrying with us writhing snakes, how the monkeys at once fled back shrieking, whilst the lemurs crowded to the front of the cage, displaying the greatest interest and not the smallest perturbation when a snake was brought so close to them that its tongue almost touched their faces. We got the impression that had the lemurs been given the opportunity, they would at once have seized and tried to devour the snake. The South American monkeys showed fear in irregular and sometimes slightly marked form. Spider-monkeys (*Ateles*) were quite as excited and alarmed as any Old World monkey. Some of the larger Cebidæ did not retreat, but uncovered their canines and looked as if they were ready to show fight. Some small specimens retreated but showed no special alarm, others were nearly indifferent. The Old World monkeys of all the genera in the Society's Collection recognised the snakes instantly and bolted panic-stricken, chattering loudly and retreating to their boxes or as high up as possible in the larger cages. Our large Baboons, including the huge Mandrill, were even more panic-stricken, jumping back in the greatest excitement, climbing as far out of reach as possible and barking. Of the Anthropoids, the Gibbons were least timid; one small agile Gibbon (*Hapale agilis*) showed no fear and very little curiosity; a larger one of the same species and a Hoolock receded but without showing panic. It is possible that the very markedly arboreal habits of the Gibbons have brought them so much less in contact with snakes that their fear of snakes is partly obliterated. The Chimpanzees, except one baby which was indifferent, recognised the snakes at once and fled backwards, uttering a low note sounding like "huh, huh." They soon got more excited and began to scream, getting high up on the branches or on the wire-work of their cages, but all keeping their eyes fixed on the snakes. Apparently they took a certain amount of courage from one another's presence, and they began slowly to draw nearer chattering loudly, but soon fled again screaming. The panic, however, at the presence of snakes was most sudden and best marked in the case of Orangs. The Society has at present two examples—a young female which came two years ago as a very small baby, and a large, probably adult male. Both of these are usually extremely slow and deliberate in their movement, but as soon as they got sight of a snake and long before it was near them, they fled silently but with the utmost rapidity, climbing as far out of reach as possible with a ludicrous celerity. It is well known that Anthropoid Apes are timid animals, readily alarmed at any strange creatures however small or harmless these may appear to be. One of our Chimpanzees was infested with large nematodes, and living examples of these that were passed with the fæces terrified the others. Earthworms similarly alarmed them, but nematodes and earthworms may have been mistaken by them for snakes. But mice, cockroaches, and guinea-pigs sometimes also terrify them extremely at first. We cannot doubt, however, that apart from this general timidity, monkeys (excluding lemurs) have a specific fear of snakes. It is probable that human beings have inherited this specific fear of snakes from their anthropoid ancestors, and that our inclination to attribute a similar fear of snakes to other animals is due not merely to erroneous observation but to an "anthropoidomorphic" prepossession.

G. M. Woodward del. et lith.

West, Newman imp

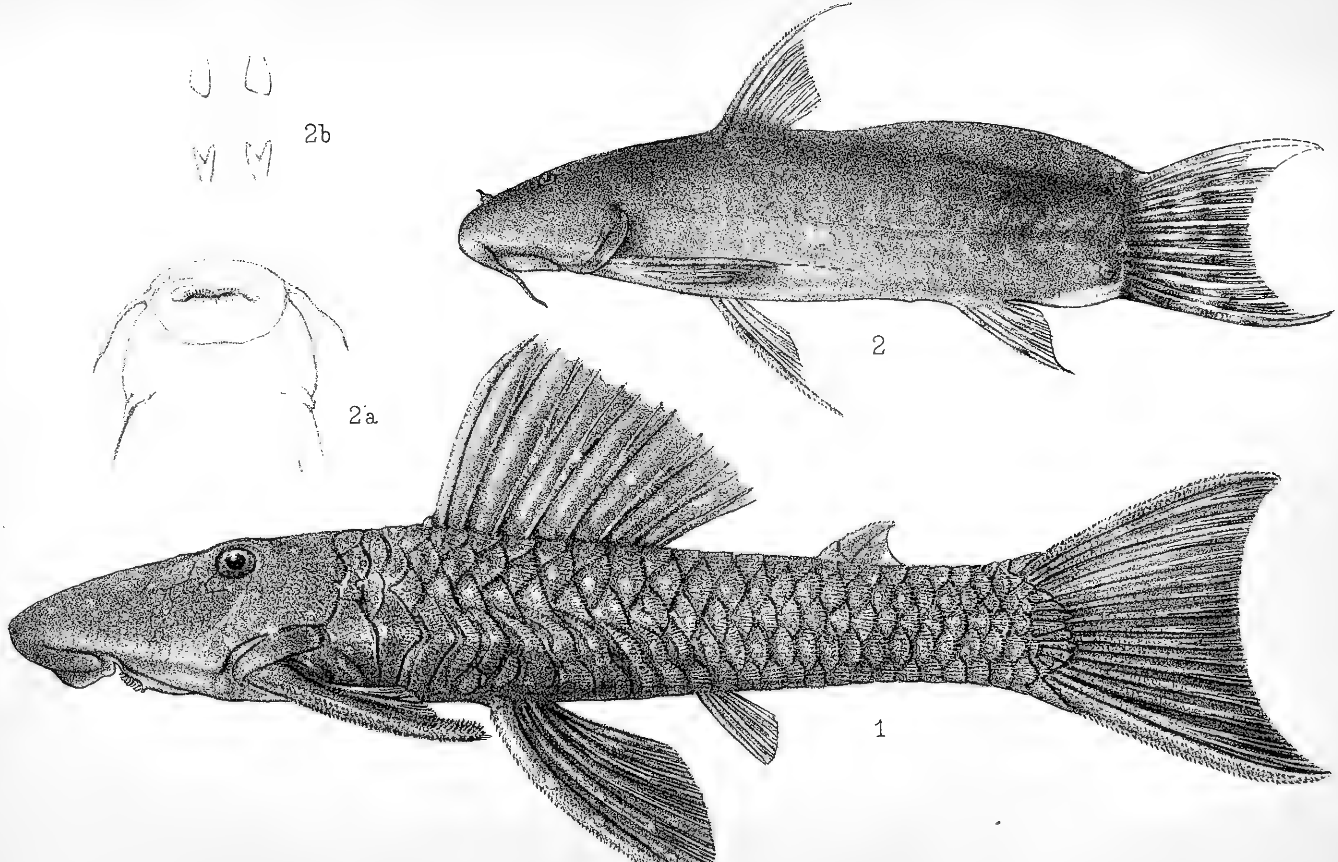
1. PLECOSTOMUS IHERINGII. 2. P. MARGARITIFER.



G.M. Woodward del. et lith.

West, Newman imp.

1. PLECOSTOMUS STRIGATICEPS. 2. ARGES RETROPINNA.



G. M. Woodward del. et lith.

West, Newman imp.

1. PLECOSTOMUS ALBOPUNCTATUS. 2. ARGES HETERODON.

5. Descriptions of new Loricariid Fishes from South America. By C. Tate Regan, M.A., F.Z.S.

[Received October 4, 1907.]

(Plates XLVII.–XLIX., and Text-figures 206–208.)

The fishes here described are a new *Otocinclus*, five new species of *Plecostomus*, and two new species of *Arges*. Since the publication of my monograph of the Loricariidæ (Trans. Zool. Soc. xvii. 1904) I have written a note* calling attention to the specific distinctness of *Plecostomus horridus* Kner and *P. tenuicauda* Stdr. from *P. emarginatus* C. & V., with which they had been united; whilst Dr. R. von Ihering† has described four new species, *P. tietensis*, *P. regani*, *P. paulinus*, and *P. hermanni*, from San Paulo, Brazil. Including the five new species described below, four of which have been sent to me by Dr. von Ihering, the known species of the subgenus *Plecostomus* (*i. e.*, with an adipose fin and without opercular bristles) now number 32, instead of the 21 described in my monograph.

Plecostomus iheringii, sp. n. (Plate XLVII. fig. 1.)

Depth of body $4\frac{2}{3}$ in the length, length of head $3\frac{1}{3}$. Depth of head $1\frac{3}{5}$ in its length, breadth of head $1\frac{1}{10}$, length of snout $1\frac{4}{5}$, diameter of eye $6\frac{1}{4}$, interorbital width $2\frac{1}{2}$. About 40 teeth on each side in both jaws; length of mandibular ramus 2 in the interorbital width. Barbel nearly as long as the eye. Snout obtuse, narrowed anteriorly; supraorbital ridges slightly raised; supraoccipital somewhat elevated posteriorly, but without median ridge, bordered posteriorly by a single scute; occipital process short; temporal plates, nuchal scutes and anterior scutes of the second series weakly keeled. Scutes spinulose, 26 in a longitudinal series, 6 between dorsal and adipose fin, 13 between anal and caudal. Lower surface of head naked except for a granular patch in front of each gill-opening; abdomen in great part naked, covered with granular scales laterally and posteriorly; a transverse strip of granular scales between the pectorals. Dorsal I 7, the first ray a little shorter than the head, when laid back extending to the third scute behind the last ray, which is $\frac{3}{5}$ as long as the first; length of base of dorsal equal to its distance from the posterior part of spine of adipose fin. Anal I 4. Pectoral spine extending to anterior $\frac{1}{4}$ of ventral fin. Caudal emarginate, the middle rays less than $\frac{3}{5}$ as long as the longest. Caudal peduncle $2\frac{3}{4}$ as long as deep. Posterior part of head with transverse stripes; fins dusky, the dorsal with the posterior half of each interradial membrane darker than the rest.

* Ann. Mag. Nat. Hist. (7) xvii. 1906, p. 94.
† Ann. Mag. Nat. Hist. (7) xv. 1905, pp. 558-561.

Hab. Rio Piracicaba, San Paulo, Brazil.

A single specimen, 150 mm. in total length, received from Dr. R. von Ihering.

Plecostomus margaritifer, sp. n. (Plate XLVII. fig. 2.)

Depth of body $4\frac{2}{3}$ in the length, length of head $3\frac{1}{3}$. Depth of head $1\frac{3}{4}$ in its length, breadth of head $1\frac{1}{8}$, length of snout $1\frac{3}{4}$, diameter of eye 6, interorbital width $2\frac{3}{4}$. Length of mandibular ramus $1\frac{4}{5}$ in the interorbital width; 18 to 20 teeth on each side in the upper jaw, 15 to 17 in the lower. Barbel $\frac{2}{3}$ the diameter of eye. Snout obtuse, narrowed anteriorly; supraorbital edges slightly raised; temporal plates not keeled; supraoccipital slightly convex, bordered posteriorly by a single scute; occipital process short. Scutes spinulose, not carinate, 27 in a longitudinal series, 7 between dorsal and adipose fin, 13 between anal and caudal. Lower surface of head and abdomen naked, except for some small scattered granules. Dorsal I 7; first ray a little longer than the head, when laid back extending to the sixth scute behind the last ray, which is less than $\frac{1}{2}$ as long as the first. Length of base of dorsal equal to its distance from tip of spine of adipose fin. Anal I 4. Pectoral spine extending to anterior $\frac{1}{4}$ of ventral fin. Caudal emarginate, the middle rays a little more than $\frac{3}{5}$ as long as the longest. Caudal peduncle $2\frac{3}{5}$ as long as deep. Scattered rounded pale spots on head and body; fins dusky, the dorsal with the posterior half of each interradial membrane blackish.

Hab. Rio Piracicaba, San Paulo, Brazil.

A single specimen, 160 mm. in total length, received from Dr. R. von Ihering.

Plecostomus strigaticeps, sp. n. (Plate XLVIII. fig. 1.)

Depth of body 5 in the length, length of head $3\frac{1}{5}$ to $3\frac{2}{5}$. Depth of head $1\frac{2}{3}$ in its length, breadth of head 1 to $1\frac{1}{7}$, length of snout $1\frac{3}{4}$ to $1\frac{5}{6}$, diameter of eye 5 to $5\frac{1}{2}$, interorbital width $2\frac{2}{3}$. Length of mandibular ramus $1\frac{2}{3}$ in the interorhital width; about 60 teeth on each side in both jaws. Barbel $\frac{1}{2}$ to $\frac{2}{3}$ the diameter of eye. Snout broad, rounded; supraorbital edges not or scarcely raised; temporal plates not keeled; supraoccipital slightly convex, without median ridge, bordered posteriorly by 1 or 2 scutes; occipital process short. Scutes spinulose, not carinate, 26 in a longitudinal series, 6 or 7 between dorsal and adipose fin, 12 between anal and caudal. Lower surface of head naked except for a granular patch in front of each gill-opening; abdomen nearly completely covered with granular scales except for a naked area in front of each ventral fin. Dorsal I 7, the first ray a little shorter than the head, when laid back extending to the second or third scute behind the last ray, which is $\frac{1}{2}$ as long as the first. Length of base of dorsal equal to its distance from the middle of the spine of adipose fin. Anal I 4. Pectoral spine extending to anterior $\frac{1}{3}$ of ventral fin. Caudal emarginate, the middle rays less than $\frac{3}{5}$ as long as the longest. Caudal peduncle $2\frac{3}{4}$ as long as deep. Posterior part of head with undulating stripes; dorsal fin with the posterior part of each interradial membrane dusky.

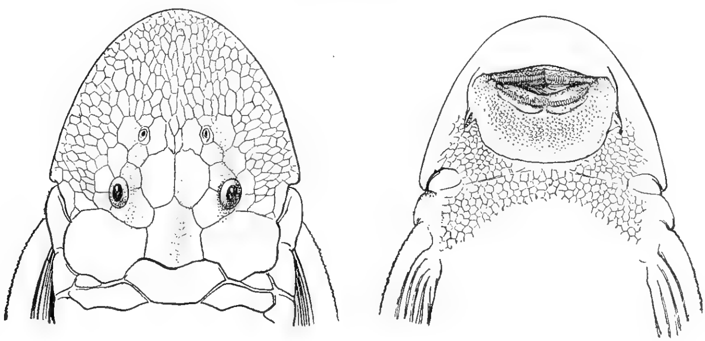
Hab. Rio Piracicaba, San Paulo, Brazil.

Two specimens, 150 and 200 mm. in total length, received from Dr. R. von Ihering.

PLECOSTOMUS ALBOPUNCTATUS, sp. n. (Plate XLIX. fig. 1.)

Depth of body $5\frac{1}{2}$ to 6 in the length, length of head 3 to $3\frac{1}{4}$. Depth of head 2 in its length, breadth of head $1\frac{1}{10}$, length of snout $1\frac{3}{5}$ to $1\frac{2}{3}$, diameter of eye 9 to 10, interorbital width 3 to $3\frac{1}{5}$. Length of mandibular ramus $1\frac{1}{2}$ to $1\frac{3}{4}$ in the interorbital width; 26 to 32 teeth on each side in the upper jaw, 22 to 26 in the lower. Barbel very short. Snout broad, rounded; supraorbital edges not or scarcely raised; temporal plates not keeled; supraoccipital slightly convex, without median ridge, bordered posteriorly by a single scute; occipital process short. Scutes spinulose, not carinate, 26 in a longitudinal series, 6 or 7 between

Text-fig. 206.



a *b*

Plecostomus albopunctatus.

Head seen from above (*a*) and below (*b*).

dorsal and adipose fin, 12 between anal and caudal. Lower surface of head and abdomen almost completely covered with small granular scales. Dorsal I 7, the first ray $\frac{3}{5}$ to more than $\frac{2}{3}$ the length of head, when laid back extending just beyond the base of the last ray, which is $\frac{3}{5}$ as long as the first. Length of base of dorsal equal to its distance from the posterior part of spine of adipose fin. Anal I 4. Pectoral spine extending to base of ventral fin. Caudal slightly emarginate, the median rays $\frac{2}{3}$ as long as the longest. Caudal peduncle $2\frac{1}{2}$ as long as deep. Small rounded whitish spots on head and body and on the rays of the fins; fins dusky, the posterior half of each interradial membrane of the dorsal darker than the rest.

Hab. Rio Piracicaba, San Paulo, Brazil.

Two specimens, 170 and 220 mm. in total length, received from Dr. R. von Ihering.

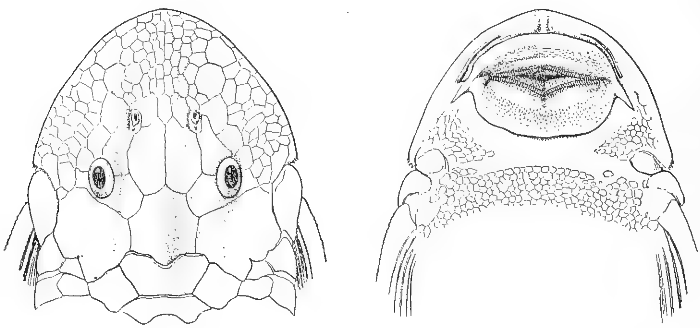
PLECOSTOMUS GOYAZENSIS, sp. n.

Plecostomus latirostris (part.) Regan, Trans. Zool. Soc. xvii. 1904, p. 213.

Depth of body 5 in the length, length of head $3\frac{1}{3}$. Depth of head $1\frac{3}{5}$ in its length, breadth of head 1, length of snout $1\frac{3}{4}$, diameter of eye 7, interorbital width $2\frac{3}{5}$. Length of mandibular ramus $1\frac{4}{5}$ in the interorbital width; 28 teeth on each side in both jaws; barbel $\frac{3}{5}$ the diameter of eye. Snout broad, rounded; supraorbital edges slightly raised; supraoccipital with median ridge, bordered posteriorly by a single scute; temporal plates not distinctly keeled. Scutes spinulose, the upper and anterior ones very weakly keeled, 27 in a longitudinal series, 6 between dorsal and adipose fin, 13 between anal and caudal. Lower surface of head and abdomen nearly completely covered with small granular scales. Dorsal I 7; length of base equal to the distance from tip of spine of adipose fin. Anal I 4. Pectoral spine extending to anterior $\frac{1}{3}$ of ventral. Caudal emarginate. Caudal peduncle 3 times as long as deep. Uniformly brownish (in spirit).

Hab. Goyaz.

Text-fig. 207.



a *b*

Plecostomus goyazensis.

Head seen from above (*a*) and below (*b*).

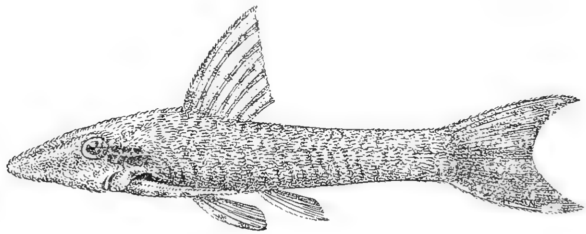
A single specimen, 260 mm. in total length, received in 1889 from the Museum of Comparative Zoology, Cambridge, Mass., U.S.A.

P. latirostris is distinguished by the more slender and more numerous teeth and by the shorter caudal peduncle.

Otocinclus paulinus, sp. n.

Depth of body 5 in the length, length of head $2\frac{4}{5}$. Diameter of eye $7\frac{1}{2}$ in the length of head, interorbital width $2\frac{2}{5}$, length of snout $2\frac{2}{5}$. Occipital region evenly convex, without crests. Scutes spinulose, not carinate, 22 in a longitudinal series. Lower surface of head with a naked area in front of the clavicles; abdomen posteriorly with numerous small plates, anteriorly naked except

Text-fig. 208.



Otocinclus paulinus (× 2).

for a series of plates on each side. Dorsal I 7; origin above the base of ventral; no adipose fin. Anal I 4. Pectoral spine extending beyond middle of ventral. Caudal emarginate. Caudal peduncle 3 times as long as deep. Caudal blackish, except the posterior half of the upper lobe, which is pale with dark spots; other fins pale with series of dark spots.

Hab. Rio Piracicaba, San Paulo, Brazil.

A single specimen, 35 mm. in total length, received from Dr. R. von Ihering.

Arges heterodon, sp. n. (Plate XLIX. fig. 2.)

Length of head 4 in the length of the fish. Nasal flap produced into a short barbel. Interocular width equal to the distance from eye to posterior nostril and 3 in the length of head. Width of mouth $\frac{1}{2}$ the length of head; outer series of teeth in the præmaxillaries unicuspid, more or less compressed, expanded and truncated; mandibulary teeth acutely bicuspid; barbel just reaching the gill-opening. Dorsal I 6; first ray produced, longer than the head; adipose fin elongate, strongly developed, without trace of a spine. Pectoral spine probably produced and extending beyond the middle of ventral (broken off on each side); ventrals longer than the head, originating a little in advance of the origin of dorsal, extending nearly to the vent, which is situated at more than $\frac{4}{5}$ of the distance from the base of the ventrals to the origin of the anal. Anal I 6. Distance from tip of snout to origin of dorsal $2\frac{1}{2}$ in the length of the fish, from base of last anal ray to that of the caudal $5\frac{1}{2}$. Greyish, spotted and marbled with blackish; vertical fins with series of blackish spots.

Hab. Jimenez, Western Colombia.

A single specimen, 110 mm. in total length, collected by Mr. Palmer.

This species is allied to *A. longifilis* Stdr., from Peru, which is known to me only from Steindachner's description and figures, but which is separated at least by the smaller mouth, longer caudal peduncle, and different coloration. The teeth in the upper jaw in *A. heterodon* approximate in form to the incisor-like teeth of *Arges peruanus* and *A. simonsii.*

Arges retropinna, sp. n. (Plate XLVIII. fig. 2.)

Length of head $3\frac{1}{3}$ to $3\frac{1}{2}$ in the length of the fish. Interocular width less than the distance from eye to posterior nostril, nearly 4 in the length of head. Width of mouth a little more than $\frac{1}{3}$ the length of head; outer series of teeth of the præmaxillaries unicuspid, acute; mandibulary teeth bicuspid; barbel extending not more than $\frac{1}{2}$ of the distance from its base to the gill-opening. Dorsal I 6; first ray not produced, $\frac{1}{2}$ or a little more than $\frac{1}{2}$ the length of head; adipose fin with a well-developed movable spine, which is inserted at a distance from the caudal equal to $\frac{1}{2}$ the length of the middle rays of the latter. Pectoral spine not produced, but extending to middle of ventral; ventrals originating well in advance of the dorsal, not reaching the vent, which is situated at $\frac{4}{5}$ of the distance from base of ventral to origin of anal. Anal I 6. Distance from tip of snout to origin of dorsal $2\frac{1}{6}$ to $2\frac{1}{4}$ in the length of the fish, from base of last ray of anal to that of the caudal $7\frac{1}{2}$. Greyish, clouded with darker and with some small pale spots; dorsal, anal, and pectoral with a series of dark spots; pectoral dark at the base; caudal blackish at the base and also posteriorly.

Hab. Jimenez, Western Colombia.

Two specimens (♀), 55 and 65 mm. in total length, collected by Mr. Palmer.

This species is allied to *A. homodon* Rgn. and *A. boulengeri* Rgn., but is easily distinguished by the smaller and more posteriorly placed dorsal fin, shorter barbels, shorter caudal peduncle, &c.

EXPLANATION OF THE PLATES.

Plate XLVII.

Fig. 1. *Plecostomus iheringii.*
2. *Plecostomus margaritifer.*

Plate XLVIII.

Fig. 1. *Plecostomus strigaticeps.*
2. *Arges retropinna.* 2 *a.* Head seen from above. 2 *b.* Head seen from below. 2 *c.* Teeth.

Plate XLIX.

Fig. 1. *Plecostomus albopunctatus.*
2. *Arges heterodon.* 2 *a.* Head seen from below. 2 *b.* Teeth.

6. Notes on Mayer's Pigeon (*Nesœnas mayeri*). By Lieut.-Colonel N. Manders, F.Z.S.

[Received August 8, 1907.]

This bird is now so nearly approaching extinction, that it is perhaps advisable to put on record all available information regarding its distribution and habits, and I have therefore compiled a few notes embodying all I know and have ascertained from other persons about this bird, which may be interesting to ornithologists and naturalists generally.

Before the indigenous forests were largely destroyed it was probably abundant all over the island of Mauritius, but its range has become gradually more and more circumscribed, until at the present day it is entirely confined to a small range of forest-clad hills in the south-western corner of the island known as the Savanne district, comprising a country some eight miles from east to west and from two to three from north to south. The hills rise abruptly from the sea-coast to an elevation varying from a thousand to nearly two thousand feet, thence extending to a plateau covered now with light scrub jungle which stretches northwards at a gradually decreasing elevation to the central plain, which is now entirely under cultivation. I have never observed the bird in this scrub jungle, and it only visits it at a certain period of the year, under conditions to which I shall subsequently allude.

For administrative purposes this range of hills is divided up into the following forest districts, all nearly continuous and in all of which the bird is found:—Les Mares, and Grand Bassin, where it is most common; Calbot, Kanaka, Coutanceau and Dayot; a few at Charmarel; and I have once seen it at Morne Brabant in the extreme south-western corner of the island.

The character of these forests is much the same; they are very thick and almost impenetrable owing to the multitude of seedlings and young trees, which are allowed by an inefficient Forest Department to grow up and choke each other by their tangled growth. There is a singular absence of large trees, one of three feet in diameter is rare, and these usually show signs of incipient decay. For six months in the year the rainfall is very heavy, sometimes it rains continuously for days, making the woods almost one vast swamp. Under these circumstances it is frequently difficult to get near the birds to observe their habits; it requires patience and a disregard for one's personal comfort.

In the early morning shortly after sunrise they come out and sun themselves, and their "whoo" "whoo" may be heard at a considerable distance. My friend M. Georges Antelme, who has probably a more extensive acquaintance with it than any other naturalist, gives it as his opinion that the number of birds still existing does not exceed one hundred and fifty pairs, and from my own frequent rambles through these forests in the last two and a half years, I should say this is an outside estimate. It is somewhat difficult at first sight to account for their diminution, when we consider that they are not destroyed by Europeans, and that possessing a character for being unwholesome to eat they are not trapped. It may fairly be said that in this instance at any rate man is not directly responsible for its extinction. I say directly, but indirectly he undoubtedly is. The Portuguese, who had a penchant for monkey-flesh, introduced an Indian species of monkey into the island shortly after they first discovered it in the middle of the sixteenth century. Until the last few years, these animals confined their depredations to the jungle-covered hills surrounding Port Louis and the adjoining cane-fields. Now, by some unfortunate mischance, but probably by a necessary emigration owing to their increasing numbers, they have spread to all parts of the island, and the Savanne forests are overwhelmed by their numbers. Not only do they do incredible damage by destroying the fruits of valuable forest trees, but they destroy also the seedlings and tender shoots of trees of larger growth; and large numbers of natives are constantly employed to keep them off the cane-fields, where they do enormous mischief in the shortest possible time. The Pigeons are totally unable to resist this invasion of their last refuge as their nests, eggs, and young are ruthlessly destroyed; and the forest keepers inform me that in consequence the birds have almost ceased to breed. It was in the Savanne forest that the last specimen of the Dutch Pigeon (*Alectrœnas nitidissima*), now in the Port Louis Museum, was shot in the year 1826. It seems strange that one species should survive the other for close on a hundred years, and were it not for the pestilent monkey would probably do so for another hundred. I venture to give the following explanation of the phenomenon.

Heemskerk, who visited the island in 1601, mentions that the sailors knocked down with their sticks a large number of pigeons with "red tails," which on being eaten proved so disconcerting to the Dutchmen's stomachs, making them violently sick, that they subsequently left them severely alone, and they probably passed on an account of their unpleasant experiences to others of their countrymen. This evil reputation has happily survived to the present day and with it the pigeon; whereas the Dutch Pigeon being a toothsome and withal a wholesome diet, has succumbed. As a matter of fact Mayer's Pigeon is not unwholesome, though this fact is carefully hidden away in the bosoms of local naturalists. The Curator of the Port Louis Museum, who skinned one, had sufficient courage to tackle the flesh, and found it uncommonly tough but nothing more. At a certain season of the year the birds, as I have said, leave the forest and come out into the adjoining scrub to feed on the berries of the "Tomdamane" (*Aphloia theiformis*), of which they are inordinately fond, and on which they gorge themselves to repletion. It appears that these berries have some intoxicating properties, as they render the birds so helpless that they can be readily snared by a noose at the end of a stick.

It is quite possible that when in this condition the flesh becomes unwholesome for the time being. It is to be noted that Heemskerk specially mentions the red tails of the pigeons, from which I conclude he means "Mayer's Pigeon," as this is very conspicuous especially when in flight.

It nests twice in the year, in October and again in January. The nest is similar to that of the common Wood-Pigeon and merely consists of a few sticks laid together in the branches of a tree a few feet from the ground. The eggs are pure white, similar to but decidedly larger than those of the wood-pigeon. I am inclined to think that the young birds for some time are of an uniform rusty red much like the tail of the adult bird, and that it is only subsequently that they assume the adult plumage. In confinement they lose to a great extent their extreme delicacy of colouring, the bill loses a great deal of its brilliant crimson, and the plumage on the neck and breast assumes a dull pinkish slate-colour rather than a beautiful rosy pink. In characteristics generally it is much more a dove than a pigeon. In confinement at any rate they are extremely pugnacious, and being essentially bullies the bird which gains the upper hand certainly does its best to hunt the other to death.

It is interesting to note that its mental development is at the same level as when the island was first discovered. It exhibits not the slightest fear of man, and at the present day it would be as easy to knock them over with a walking-stick as it was three hundred years ago. The climate of these Mauritian forests is of sub-tropical character, and I have no doubt that with very slight protection it would do well in England. So far it has not bred in confinement, but I am inclined to think that the conditions under which they were kept were not favourable. I should much like to see a successful attempt in England, the more so as the time is fast approaching when Mayer's Pigeon will be a thing of the past.

7. On some Points in the Structure of *Galidictis striata*. By FRANK E. BEDDARD, M.A., F.R.S., Prosector to the Society.

[Received October 17, 1907.]

(Text-figures 209–216.)

In continuation of a series of communications* to the Society upon the anatomy of the smaller Carnivora, I beg leave to offer the following notes upon the little-known Madagascar Viverrine, *Galidictis striata*, which has not, so far as I am aware, been

* "On the Visceral and Muscular Anatomy of *Cryptoprocta*," P. Z. S. 1895, p. 430. "On certain points in the Anatomy of the Cunning Bassarisc, *Bassariscus astutus*," ib. 1898, p. 129. "On the Anatomy of *Bassaricyon alleni*," ib. 1900, p. 661. "Some notes upon the Anatomy of the Ferret Badger, *Helictis personata*," ib. 1905, p. 21.

dissected. The specimen which I dissected is a female, and I have preserved the skin for future reference. It died on September 18th last, apparently from congested lungs. The viscera were in an excellent state for anatomical investigation, save for the fact that the body was rather fat. This, however, has not interfered with the possibility of recording certain facts of importance in the systematic placing of this Æluroid.

The principal external and osteological characters have been given by the late Dr. Mivart *, who has referred to previous literature upon the genus and upon its immediate allies, *Galidia* and *Hemigalidia* (a genus founded by Dr. Mivart in that paper). He distinguishes *Hemigalidia* from *Galidia* and from *Galidictis* by the fact that the former possesses the first premolar, which is alleged to be missing in both *Galidia* and *Galidictis*. This generic distinction cannot, however, be enforced. In a specimen of *Galidia elegans*, formerly living in the Society's Gardens (it was acquired in 1886), and which is hardly likely to have been wrongly named, the skull shows most distinctly and on both sides the first premolar, a small tooth with only one root. There is obviously, however, no such tooth in *Galidictis*, where indeed there is no diastema between the canine and premolar 2. It is therefore *Galidictis* which is to be contrasted with *Galidia* and *Hemigalidia* (if, indeed, the generic distinction is to be retained), and *not* the latter genus with the two former in this particular. As to the large size of the canines in *Galidictis*, I confirm Dr. Mivart's statements.

The only external character to which I wish to direct attention, is the condition of the glands in the neighbourhood of the anus and of the vulva. Dr. Mivart has figured these parts in a female *Genetta tigrina* †, where he indicates clearly the folds of the scent-gland lying behind the vulva and forming externally with the vulva one common region of the integument. In a later part of the same paper ‡, Dr. Mivart distinguishes the Viverrinæ (of which *Genetta* is a genus) from the Herpestinæ, Galidictinæ, and some others by the existence in the first-named and the absence in the two latter of the "prescrotal glands." With regard to *Galidictis*, this assertion is only based upon its likeness to *Herpestes* &c.; for Dr. Mivart writes § with respect to that genus:—"I can find no record of the condition of the anus, or of the number of anal glands, neither any note as to prescrotal glands; I, however, anticipate that the latter are wanting, that there is but a single pair of anal glands, and that the anus opens onto the surface of the body, and not into a pouch." It is perhaps a little remarkable that Dr. Mivart should have postulated the absence of a pouch into which the anus opens in *Galidictis*, in view of his opinion that the subfamily Galidictinæ lies between the Viverrine and Herpestine groups, "though more nearly allied to the latter than

* "On the Classification and Distribution of the Æluroidea," P. Z. S. 1882, p. 135.

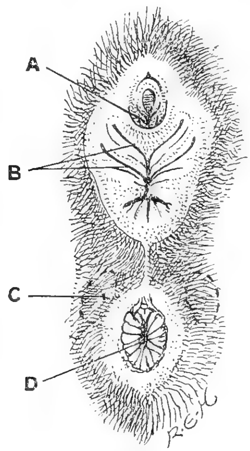
† P. Z. S. 1882, p. 156, fig. 5.

‡ Id. ibid. p. 205.

§ Ib. p. 187.

to the former"; for in the genus (and I am able to confirm this by my examination of *Herpestes fulvescens*) *Herpestes* there is certainly present this pouch into which the anus opens. Dr. Mivart is, however, quite correct in his prophecy as the accompanying illustration (text-fig. 209) will show. The anus, which is rather large, appears to open directly on the surface of the body, and there are two large anal glands. On the other hand, as the same figure shows, the "prescrotal" or scent-glands are as

Text-fig. 209.



Anus, Vulva, and Scent-Gland of *Galidictis striata*.

A. Vulva. B. Scent-gland ("prescrotal gland"). C. Anal glands, represented as visible through the skin. D. Anus.

undoubtedly present. The actual glands, as visible on the opposite side of the piece of skin, are smallish (smaller than the anal glands) oval glands. In regard to these external structures, *Galidictis* is therefore more like the Viverrinæ than the Herpestinæ. For the former sometimes have, while the Herpestinæ have not, the scent-gland; and the anus in them (the Viverrinæ) does not open into a pouch, which it frequently does among the Herpestines.

§ *Alimentary Canal.*

In the consideration of the viscera belonging to this system as well as to others, Dr. Mivart's memoir upon the anatomy of the catlike Carnivora * has been largely consulted as a storehouse of information upon the anatomy of these animals. He includes in

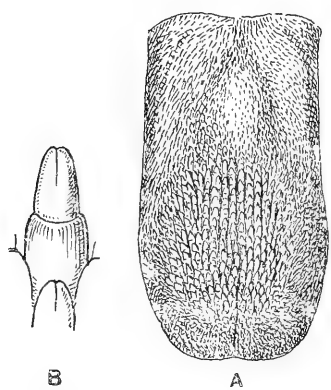
* "Notes on some Points in the Anatomy of the Æluroidea," P. Z. S. 1882, p. 459.

that paper a few notes upon the Madagascar *Galidia*, which is the nearest ally of the present genus *Galidictis*. I have myself particularly compared *Galidictis* with *Genetta vulgaris*, of which a specimen happened to fall into my hands at the time that I was studying the former. With regard to a number of the facts which I describe in the present communication, there is nothing recorded which allows of a careful comparison with other genera of Herpestids.

The *Tongue* shows a character found in certain Viverridæ in that towards the free tip there is a patch of specially enlarged conical papillæ. This patch does not reach the edge of the tongue anywhere.

As far as I can gather from Mivart's descriptions, this is much like what is found in *Galidia* and certain Herpestines. Dr. Mivart remarks that in the Genet there are no enlarged papillæ forming a patch upon the dorsum of the tongue. In *Genetta vulgaris* the entire tongue is covered with papillæ which are quite as large as those forming the patch of enlarged papillæ in *Galidictis*. In the figure (text-fig. 210) illustrating the tongue an isolated spine considerably magnified is shown. It will be seen that there is a tendency towards bifidity at the tip.

Text-fig. 210.



A. Fore part of Tongue of *Galidictis striata*. B. A single papilla from the anteriorly situated patch of papillæ in the same.

The *Stomach* of *Galidictis* is, as it would appear, much like that of *Galidia*; for it is large and globular, with but a slightly projecting pyloric region. It contrasts with *Genetta* and *Arctictis*, which in these particulars are at the opposite extreme of the series, with comparatively narrow stomachs and well developed, long, narrow pyloric portion. It also contrasts in other particulars with the stomach of the also Madagascar genera *Eupleres* * and the archaic type of existing Viverrid (as some think it) *Nandinia binotata* †. In both of these latter the stomach approximates very closely in its characters to that of *Arctictis*, as described by the late Prof. Garrod.

The *Intestines* of *Galidictis* have in their convolutions the simple character of those of other members of this group, as is shown in the figures of Dr. Mitchell ‡. It is noteworthy that the duodenal loop of *Galidictis* approaches more to a square with rounded angles than in *Genetta vulgaris*, where the first section of the duodenum forms a more slight and C-shaped curve; that is to say, in the latter type the lower end of the duodenal loop does not run so parallel with, and so exactly in the opposite direction to, the upper limb of the loop as it does in *Galidictis*. Both these types, however, show one difference from the intestine in *Genetta pardina* and *Arctictis binturong*. In the two latter the whole of the intestine forms a simple coil with no secondary mesenteric connections between its coils. The whole canal forms a simple though convoluted tube supported throughout by a continuous mesentery. In *Galidictis* and *Genetta vulgaris* the lower end of the duodenum, where it bends over to the left side of the body, is attached by a mesentery to the mesocolon. It is perhaps remarkable to find a difference in this matter between two species of the same genus. But it will be recollected that while *Genetta vulgaris* is Palæarctic, *G. pardina* is Æthiopian.

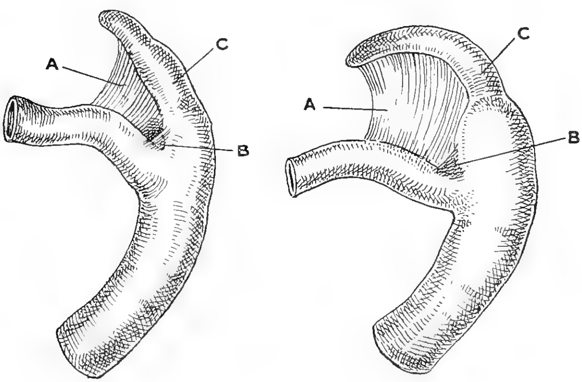
The proportion between the large and small intestines are in *Galidictis* as they are in other Viverrines; *i. e.*, the large intestine is very short, both actually and relatively. There is, however, a difference between *Galidictis* and *Genetta vulgaris*. For in the latter, which is a larger animal, the large intestine is $4\frac{3}{4}$ inches in length and is actually, and therefore much more so relatively, shorter than it is in *Galidictis* where it measures $5\frac{1}{2}$ inches. In *Genetta* in fact the whole of the short large intestine is perfectly straight; there is no bend from its origin to the anus. In *Galidictis*, on the other hand, the upper extremity of the large intestine is bent round to the right, thus forming a rudimentary transverse colon. Indeed, it could not lie straight; for if artificially so placed it reaches the diaphragm. The attachment of the duodenum where it bends to the left of the mesocolon is by no means a characteristic of the Æluroidea as opposed to the Arctoidea. For of the Kinkajou (*Cercoleptes caudivolvulus*) Owen wrote § :—"The *duodenum* made a large semicircular sweep downwards, backwards, and to the left, being loosely connected by a wide duplicature of peritoneum for the greater part of its course; it was also

* Carlsson, Zool. Jahrb., Abth. f. Syst. xvi. p. 217.
† Id. ibid. xiii. p. 509.
‡ "The Intestinal Coils in Mammals," Trans. Zool. Soc. vol. xvii. p. 494 &c. figs. 33 &c.
§ P. Z. S. 1835, p. 119.

connected with the colon by a fold of peritoneum continued from it." This is obviously the same that I have described above in *Galidictis.* I may also observe that I am able to confirm from my own dissections Owen's account of *Cercoleptes* so far as concerns the course of the intestine, and in some other facts to which I may have occasion to refer hereafter. It is important to notice that in this, as in other anatomical features, there is no strict line of demarcation between the Arctoid and Æluroid Carnivora.

The *Cæcum* of *Galidictis* seems to resemble very closely that of its near ally *Galidia*—to judge from the figure of the cæcum of the latter given by Dr. St. George Mivart in his memoir already referred to. It is long (for an Herpestid) and pointed and thinner at the free end. There is a matter concerning the cæcum in these animals that has not been, I believe, referred to. This concerns the mesentery attaching the cæcum to the small intestine. In *Galidictis* an anangious fold of membrane binds the proximal half of the cæcum to the small intestine. In *Herpestes fulvescens* (see text-fig. 211) this membrane is more

Text-fig. 211.



Cæca of *Galidictis striata* (left-hand figure) and *Herpestes fulvescens* (right-hand figure).

A. Median frenum. B. One of the lateral mesenteries. C. Cæcum.

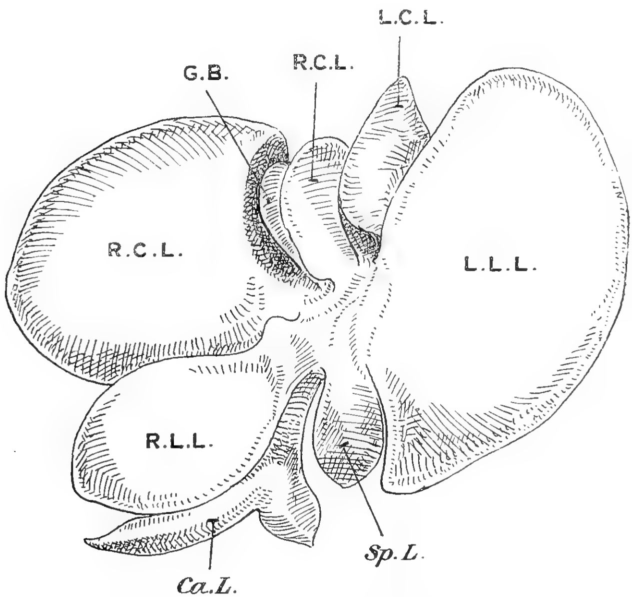
extensive and nearly reaches the tip. A more careful examination reveals also the presence of a much less developed fold on either side of the median frenum which bears the blood-vessels supplying that region of the gut. These lateral membranes are of importance in that they are better developed in some other animals. I have myself referred to them in Lemurs *. Even in the more rudimentary cæcum of *Genetta vulgaris* the same three membranes

* "Additional Notes upon *Hapalemur griseus,*" P. Z. S. 1891, p. 451.

are easily to be recognised. Another fact in reference to the cæcum of *Galidictis* is the existence of a lymphatic gland just at its junction with the intestine. I found the same state of affairs exactly repeated in *Genetta vulgaris*. The fact would therefore appear to be of some importance.

The *Liver* of *Galidictis* is represented from the abdominal side in the accompanying figure (text-fig. 212). The diaphragmatic view of this viscus shows that the gall-bladder is just visible on that surface through the cleft right central lobe. The principal features relating to the shapes and relative sizes of the different lobes are plainly shown, and obviate the necessity of a full description of the same. I would call attention to the large size of the caudate lobe and to its bifid free extremity. The Spigelian lobe is also larger than in some animals.

Text-fig. 212.



Abdominal surface of Liver of *Galidictis striata*.

Ca.L. Caudate lobe. G.B. Gall-bladder. L.C.L. Left central lobe. L.L.L. Left lateral lobe. R.C.L. Right central lobe. R.L.L. Right lateral lobe. *Sp.L.* Spigelian lobe.

The *Spleen* has the usual elongate form that it shows in the Carnivora, the duodenal end being rather broader than the opposite extremity.

Pancreas.—This gland is not dealt with by Mivart in his account of the abdominal viscera of the Æluroidea. In *Galidictis* it is very large and differs in its form from that of some other genera of Viverrines. In *Suricata tetradactyla* Sir Richard Owen remarked * that "the *pancreas* has a singular form. A thick transverse portion extends from the spleen behind the stomach to the *pylorus*; it then divides and forms a circle, which lies in the concavity of the great curve of the *duodenum*; sending off one or two processes in the *mesoduodenum*." This peculiar pancreas was later figured by Owen †. A pancreas of this form, is, however, neither universal among the Viverrines nor confined to that group. Dr. Mivart's figures of the stomach and pancreas of *Genetta tigrina* ‡ prove the former statement, and my own figures of *Helictis* and *Galictis* § prove the latter. With regard to *Genetta tigrina*, I may remark that *G. vulgaris* has quite the same form of pancreas, *i. e.* not forming a figure 6 as in the Suricate. The pancreas of *Genetta vulgaris* gives off a small lobe running towards the liver by the side of the bile-duct, and on the other side of the bile-duct—the left—is a completely detached lobe of pancreas whose connection with the rest of the pancreas I found it impossible to detect. I may take this opportunity of remarking that in *Arctictis binturong* the pancreas, which was not described by the late Prof. Garrod ‖ in his account of the anatomy of that animal, is on the whole like that of the Genet; that is to say, it is a straight or rather chevron-shaped gland forming no circle round the duodenal loop. In *Galidictis striata* the appearance of this gland is quite different. For it runs round the loop of the duodenum as in the Suricate; but it does not, as is the case with that animal, rejoin itself in the region of the pylorus. There is also a small process of the pancreas running up alongside the bile-duct as in *Genetta*, but no detached lobe. An anangious fold of membrane attaches the gastric region of the pancreas to the median mesentery as in other Carnivora ¶. It is very much as I have figured it in *Helictis personata*, but runs up to very nearly the end of the pancreas.

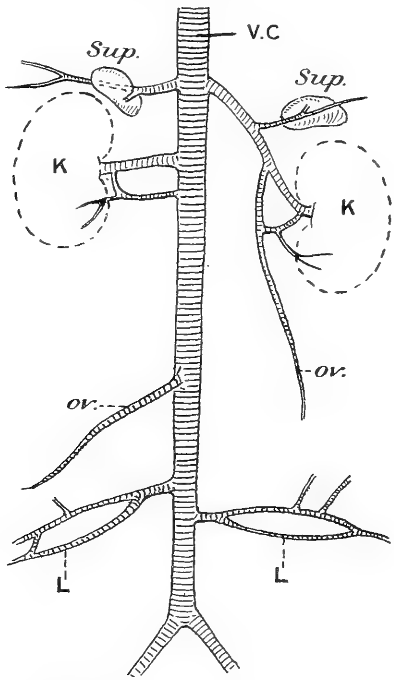
§ *The Postcaval Vein and its branches.*

Information upon the venous system of these Carnivora is so scanty, that no apology is needed for giving a description of such facts as I have observed in *Galidictis striata* and in *Genetta vulgaris*, with which I have been able to compare it. The accompanying drawings (text-figs. 213, 214) show the veins in question in the two Viverrines. In both of them the branches on the two sides of the body are asymmetrical; but the asymmetry differs in the two animals. In *Galidictis* (text-fig. 213) the veins are arranged

* P. Z. S. 1830–31, p. 40.
† Comp. Anat. vol. iii. 1868, p. 444, fig. 351.
‡ P. Z. S. 1882, p. 505, fig. 6.
§ P. Z. S. 1905, p. 25, fig. 9 & p. 26, fig. 10.
‖ "The Anatomy of the Binturong," P. Z. S. 1873, p. 196.
¶ Beddard, "On *Helictis personata*," P. Z. S. 1905, p. 24.

as follows:—On the left side, shortly behind the liver, an important vein enters the postcaval. This is composed by the union of three principal trunks; the most anterior of these is mainly fed by the body-wall, but it receives also the left suprarenal vein. The second affluent is the renal vein; the third and last is the ovarian vein, which also receives a small supplementary renal vein and a branch from the parietes. On the right side of the body these veins are all separate and enter the postcaval as separate veins. They are thus grouped: the most anterior vein is a lumbar vein receiving a suprarenal branch. This enters the postcaval symmetrically with the large compound vein of the left side.

Text-fig. 213.

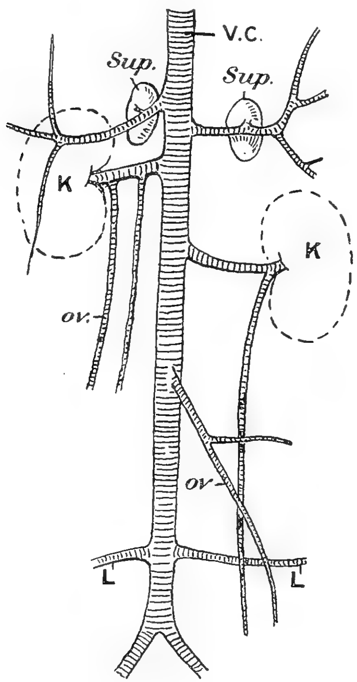


The principal branches of the Postcaval Vein of *Galidictis striata*.

K. Kidneys. L. Lumbar veins. *ov.* Ovarian vein. *Sup.* Suprarenal bodies. V.C. Postcaval vein.

Below this is the renal vein, and below this again a supplementary renal vein which also receives branches from the parietes. Much further down the postcaval vein is the entrance of the right ovarian vein. The only remaining veins before the bifurcation of the postcaval posteriorly are the right and left lumbar veins, of which the left opens into the postcaval a little below that of the right. These veins, however, are curiously symmetrical in the details of their branching. At the opening into the postcaval each is a single trunk. This immediately divides, and the anterior branch gives off two twigs running in the direction of the kidney; the two branches then reunite to form a single vein. In the case of *Genetta vulgaris* (text-fig. 214), the first vein which enters the postcaval behind the liver is a branch

Text-fig. 214.



The corresponding veins of *Genetta vulgaris*.

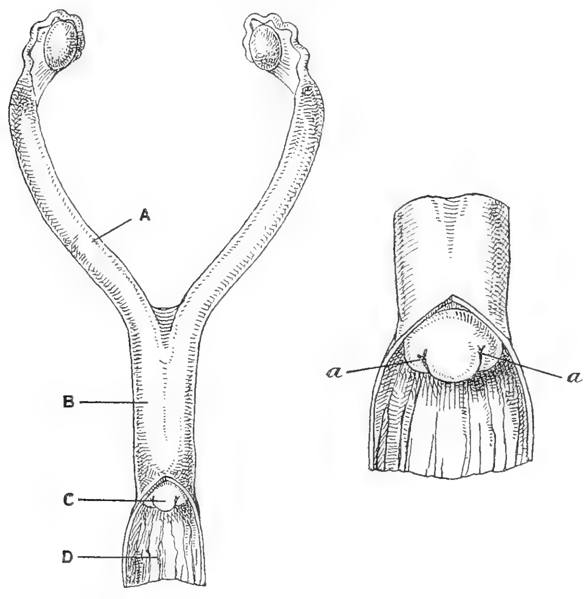
Lettering as in text-fig. 213.

on the right which is the first lumbar and suprarenal vein; the corresponding vein of the left side lies a little lower down. The renal veins are also asymmetrical, the right lying higher up than the left. There is no accessory renal vein entering the postcaval. The right renal vein gives off the spermatic. That vein of the opposite side of the body enters the postcaval considerably behind the left renal. The two posterior lumbar veins are symmetrical and are undivided trunks.

§ *Organs of Reproduction.*

The specimen of *Galidictis striata* which I dissected was a female. The organs (text-fig. 215) showed at least one remarkable peculiarity. That is, the uterus was completely double. As will be seen from the annexed drawing, the cornua of the uterus come together in the middle line posteriorly; but instead of being blended into one tube their distinctness is quite obvious, and is marked by a median depression. This is also emphasised by the distribution of the blood-vessels which supply each uterus separately, as well as giving off a median trunk which lies in the

Text-fig. 215.



Ovaries, Uteri, and Vagina of *Galidictis striata.*

The right-hand figure represents more highly magnified the opening of the uteri into the vagina.

A. Uterus. *a*. Orifices of uteri. B. Region where the two uteri are enclosed in a common sheath. C. Projection of ores uteri into vagina. D. Vagina.

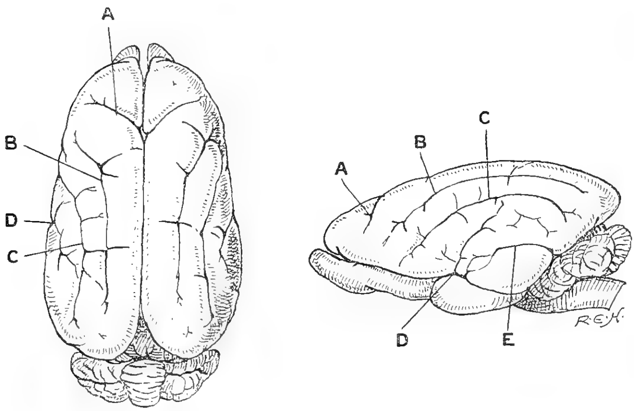
furrow between the two uteri. A dissection confirms this view of the structure of the oviducal tube. At the junction with the vagina there were two distinct and quite separate *ores uteri*. They were borne, however, upon the same projection, and, as the figure shows, lay on each side of this projecting mass. It was of course easy to pass a probe into each uterus, and their non-communication was thus rendered evident. In the Carnivora generally there are two prolonged cornua uteri and a median corpus uteri, part of which is divided by an internal septum. In *Herpestes fulvescens*, for example, and *Cercoleptes caudivolvulus* this is the case—which species I have dissected for the purposes of a comparison with *Galidictis*. It will be noticed that the remains of an interuterine mesentery is to be seen at the point where the two uteri diverge. The accompanying illustration shows also the comparative shortness of the divergent region of the uteri. In *Herpestes fulvescens* the cornua are much longer in proportion.

The ovaries of *Galidictis* are not enclosed in capsules as they are in many, if not all, of the Arctoidea. In this *Galidictis* agrees with other Æluroidea, e. g. *Herpestes fulvescens*.

§ *Brain.*

I have had the brain of this Carnivore figured in two aspects, which are reproduced in the accompanying figures (text-fig. 216).

Text-fig. 216.



Dorsal (left-hand figure) and Lateral (right-hand figure) views of Brain of *Galidictis striata*.

A. Crucial sulcus. B. Lateral sulcus. C. Suprasylvian sulcus. D. Sylvian. E. Postsylvian.

Viewed from above, the brain is seen to contrast with that of *Viverra civetta* * by reason of the large size of its crucial sulcus and the total absence of any precrucial sulcus, present in the Civet and forming in that Carnivore an "Ursine lozenge," † which also exists, according to Dr. Elliot Smith, in other Æluroids, e. g. *Felis leo* ‡. There is certainly no trace of this in *Galidictis*. In

* Cat. Mus. Roy. Coll. Surgeons, vol. ii. ed. 2, 1902, p. 249, fig. 122.
† Journ. Linn. Soc., Zool. vol. xix. 1886.
‡ Cat. Mus. Roy. Coll. Surgeons, p. 247, fig. 119.

this it agrees with *Herpestes* and *Suricata* &c. It is interesting to note the classificatory value of these facts, which appear to characterise the Viverrinæ and the Herpestinæ, and which therefore show that in this brain character at any rate *Galidictis* is Herpestine rather than Viverrine. It is furthermore to be observed that the two crucial sulci are asymmetrical, that of the right side reaching the median line at a point further back than the junction with the left crucial sulcus. The lateral sulcus differs in some respects from that of allied Carnivora. It is apparently very long and curves outwards anteriorly, reaching to a point on a level with the end of the crucial sulcus. I take it therefore that in this brain as in that of *Viverra civetta* and *Nandinia binotata* * the fissure is really a conjoined coronary and lateral. If so, it contrasts with *Herpestes* where the two fissures are separate. This combined fissure gives off in *Galidictis* an inwardly and forwardly directed fissure, which I presume to be the ansate sulcus; that of the right half of the brain is situated further forward than the other of the left side. This ansate sulcus does not occur in a good many species among the Viverridæ. But it is figured by Elliot Smith in *Herpestes* (though lying much further back than in *Galidictis*), and it occurs in *Hyæna* in a situation corresponding to that which it occupies in *Galidictis*. As bearing upon the systematic position of *Galidictis*, it is to be noted that this sulcus seems to be absent in *Viverra*.

The *Sylvian fissure* or, as Dr. Elliot Smith proposes to call the sulcus in these animals, the "feline sylvian fissure" is long. Dr. Elliot Smith has gone fully into his views † of the several fissures which exist in this region. I have only to point out to what forms *Galidictis* appears to show resemblances. The Sylvian fissure (as it has been termed by many) is much longer than in either *Herpestes* or *Viverra*. It is long, as in the Hyæna and *Proteles*, as well as in *Cryptoprocta* ‡ and *Eupleres* §. Behind it lies a well-marked postsylvian as in *Herpestes*. In front of this latter—but upon the left hemisphere only—is a small forwardly directed branch of it which I presume to be one of the ectosylvian fissures of *Herpestes* and other allied Carnivora. The suprasylvian fissure is well developed, and bends rather downwards posteriorly as in *Viverra* and *Hyæna*, instead of being straight and bent rather upward as in *Herpestes pulverulentus*. Dr. Elliot Smith comments upon the small orbital fissure of the Ichneumon just mentioned, which is so concealed owing to its forward position by the olfactory that it has been actually asserted to be absent. In *Galidictis* the fissure in question is quite like that of *Viverra*; for it is quite large and thus conspicuous as well as being lateral

* Carlsson, "Ueber die systematische Stellung der *Nandinia binotata*," Zool. Jahrb. xiii. 1900, pl. 36. fig. 7.

† *Loc. cit.* p. 245, &c.

‡ Beddard, "On the Visceral and Muscular Anatomy of *Cryptoprocta*," P. Z. S. 1895, p. 434, woodcut fig. 5.

§ Carlsson, "Ueber die systematische Stellung von *Eupleres goudoti*," Zool. Jahrb., Abth. f. Syst. vol. xvi. 1902, p. 230, pl. 10, fig. 11 *s*.

in position. There is no "fissure anterior" (anterior ectosylvian) such as occurs in *Nandinia*.

The foregoing description of anatomical facts relating to *Galidictis* may be summarised for the purpose of shortly presenting its characters and of comparing them with other Viverrid Carnivora; they are as follows:—

(1) Prescrotal (*i. e.* postvulvar) glands are present.
(2) The anus opens directly on to the surface of the body and not into a superficial cutaneous depression. There are a pair of anal glands.
(3) The stomach is not particularly elongated; it is more globular in form.
(4) The cæcum is long (for a Viverrid) and pointed at the apex.
(5) The convolutions of the brain are partly Herpestine and partly Viverrine in their characters.
(6) The uterus is completely double.
(7) The tongue has an anterior patch of conical papillæ.

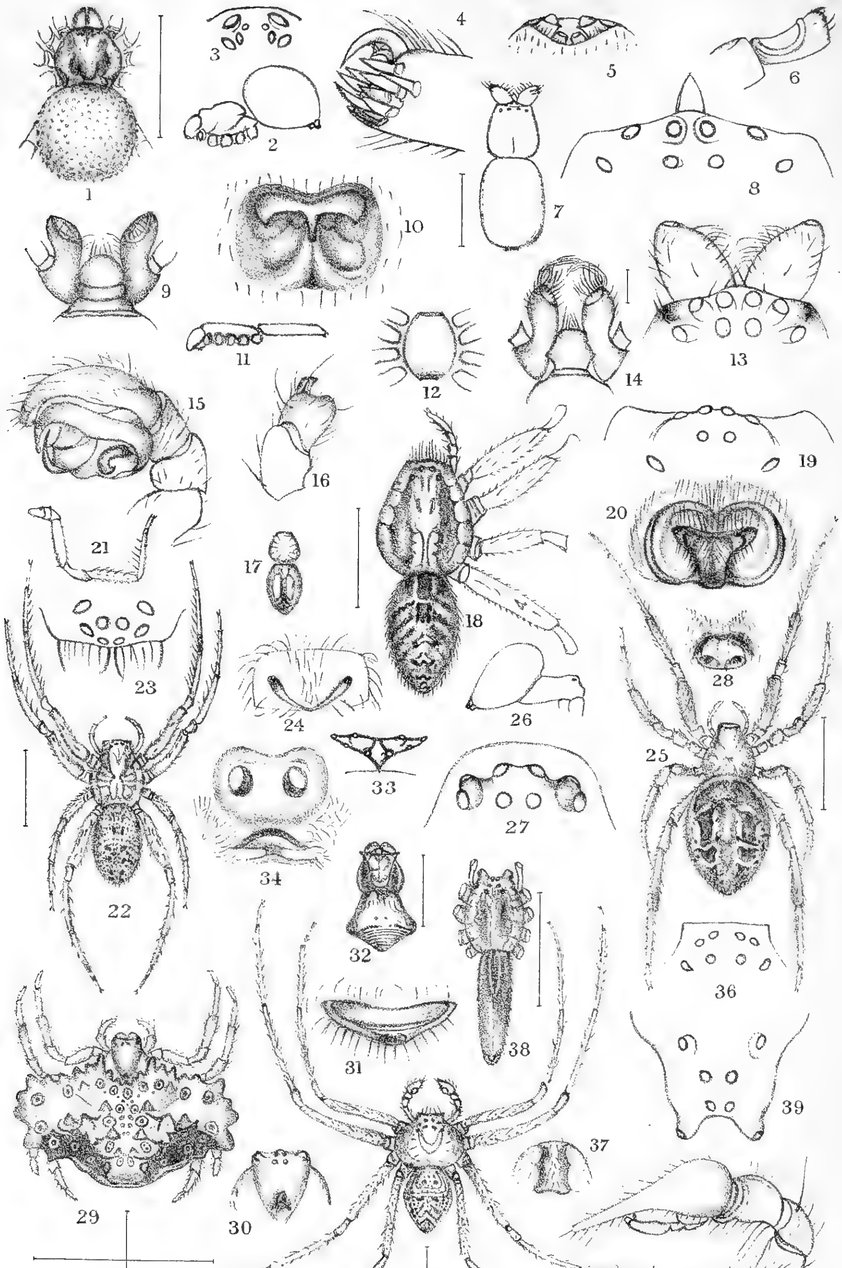
These characters collectively distinguish *Galidictis* from all other genera of Viverridæ the anatomy of which is known, and I believe that the last but one mentioned character—the completely double uterus—is new to the Carnivora. The specimen may of course be abnormal, it being the only one that has been dissected, though the probabilities are against this.

The division of the Viverridæ by Mivart into a number of subfamilies, viz.: Viverrinæ, Herpestinæ, Cryptoproctinæ, Euplerinæ, and Galidictinæ, is not used by every one. For example, in the most recent 'List of Vertebrate Animals,' * published by the Zoological Society, there is no such division adopted. If, however, this division is finally allowed, I should confirm from my own experience the justice of separating *Galidictis* in a subfamily apart from some others. But whether it will be found to agree with *Galidia* is a matter which cannot as yet be decided. For the latter genus has not been thoroughly examined. It is clear, however, that the form of the cæcum is more alike in the two genera than is that of either of them to that of other forms. But I rather gather from Mivart's classificatory scheme that *Galidia* has not the scent-glands of *Galidictis*. In this the former genus resembles *Eupleres*, as it does by the possession of four instead of three (*Galidictis*) premolars.

The relationship in fact which *Galidictis* bears to other Viverridæ is quite analogous to that which *Eupleres* bears to other Viverridæ. Carlsson has justly commented, after describing the principal facts in the anatomy of that form, upon the deduction that *Eupleres* † seems to be a more ancient type of Viverrine than the other genera, excepting only *Nandinia*, which the same

* 9th ed. 1896. Carlsson (Zool. Jahrb. xvi. Syst. Theil, p. 217) only allows Herpestinæ and Viverrinæ.

† Zool. Jahrb., Abth. f. Syst. xvi.



O. Pickard-Cambridge, delt.

M^cFarlane & Erskine, Lith. Edin^r

NEW AND LITTLE KNOWN ARANEIDEA.

writer* agrees with Winge in relegating to the otherwise extinct family of *Amphictinæ*. But while *Eupleres* leans more to the Viverrine than to the Herpestine type, it appears to me that *Galidictis* has on the whole more the characters of the Herpestinæ. But both genera combine the characters of both of the main subdivisions of the Viverridæ. This does not however mean that the two are closely allied, and that one subfamily alone is necessary for the reception of both *Eupleres* and *Galidictis*. The important differences between them are too obvious to need recapitulation here. Nevertheless, Mivart is of opinion that "of all other Viverridæ, *Eupleres* comes nearest to the genus *Hemigalidia*." Hitherto it has been impossible to say whether *Galidictis* was or was not a specialised and modern type of Herpestid. I think, however, that the facts brought forward in the present pages are conclusive against the view that *Galidictis* is a further development of either the Herpestine or Viverrine branch of the Viverridæ. In the combination of characters which it shows *Galidictis* would seem to be, like *Eupleres* and possibly *Cryptoprocta*, an ancient type of Viverrid. Like those two other Madagascar genera, *Galidictis* is an example of the retention of archaic characters so much shown in the Mascarene fauna.

November 26, 1907.

G. A. Boulenger, Esq., F.R.S., Vice-President, in the Chair.

The Secretary exhibited an oil-painting by Mr. W. Walls, R.S.A., of a young female Gorilla recently living in the Society's Gardens.

The following papers were read:—

1. On some New and Little-known Araneidea. By the Rev. O. Pickard-Cambridge, M.A., F.R.S., C.M.Z.S., &c.

[Received November 27, 1907.]

(Plate L.)

Eleven species of Araneidea are noted, or described and figured, in the following paper: one from Lagos, Portugal; three from Cape Colony, S. Africa; one from Mashonaland, E. Africa; five from the Canary Islands; and one from Old Calabar. Of the

* Zool. Jahrb., Abth. f. Syst. xiii.

foregoing, seven appear to me to be new to science; while of the remaining four, three seem to be very little known.

A point of considerable interest with respect to some of the above Spiders is that five of them were imported to England in packages of bananas (from the Canary Islands). Importations of this kind are becoming more and more frequent, and it is easy to see how perfect a material bananas furnish as a vehicle for soft-bodied creatures like Spiders.

Fam. THERAPHOSIDÆ.

Subfam. CTENIZINÆ.

Genus PACHYLOMERUS Ausserer.

PACHYLOMERUS ÆDIFICATORIUS Westwood. (Plate L. figs. 1–6.)

Pachylomerus ædificatorius Westwood, Trans. Ent. Soc. vol. iii. pp. 7–15, pl. x. (1840); E. Simon, Actes de la Soc. Linn. de Bordeaux, xlv. (1888).

Through the kindness of Mr. George Nicholson (late of the Royal Botanic Gardens at Kew) I have received from his nephew, Lieut. J. B. Nicholson, H.M.S. 'Arrogant,' female examples of this Spider and its tubular nest from Lagos, Portugal. From a comparison with Professor Westwood's description and a recollection of the type specimen (a dry one in the Oxford University Museum) I had doubts about the specific identity of the Lagos examples with that specimen. I have, however, since obtained Mons. Simon's kind examination and opinion upon the Lagos Spiders, and he feels no doubt whatever but that they are identical with *P. ædificatorius* Westw. Prof. Westwood's type came from Barbary; it appears to be abundant in West Algeria; and M. Simon tells me it has occurred at Carthagena, in Spain.

From what Lieut. Nicholson says it would appear to be not at all rare at Lagos. M. Simon believes that a species described from Spain by the late Dr. Thorell (*Ummidea picea* Thor.) is the male of this species. The difficulty of deciding on the relationship of isolated examples of the sexes in this group is well known. Naturalists and collectors who may have the chance of being able to work out this point in respect to the present species at Lagos have an opportunity to deserve well of their Arachnological brethren.

I have given (Pl. L. figs. 1–6) some details of the Lagos examples, which I conclude to be hardly adult. There is a point of much interest in respect to the nests sent to me by Lieut. Nicholson; these tubular nests not only have a hinged lid at the upper end (as described and figured by Westwood), but another, of a thinner texture and distinctly hinged, at the lower end also. The use and purpose of this arrangement, which is hitherto without parallel, I believe, in the known history of any described Trapdoor Spider, were not easy to be conceived, especially as I had at first no opportunity to ascertain whether this lower trap-door led to any other tube or cavity. In reply, however, to questions I have since asked Lieut. Nicholson, I understand that there is a more or less distinct kind of empty chamber, but without any silk lining, at the bottom of the tube. Mons. Simon (*l. c. supra*) does not mention the lower lid. There is here again a chance for a local collector to ascertain with care and patience (such as that shown by the late Mr. Moggridge in his careful study of the Trapdoor Spiders of Southern France) what is the extent of the development and the use of the lower door in the nest of the Lagos Spider. Lieut. Nicholson and a brother officer, Lieut. Walter Stokes, who assisted him, appear to have satisfied themselves that the bottom chamber was not used as a "storehouse." I may add that, in company with the nests of *Pachylomerus*, Lieut. Nicholson found nests (with examples of the Spider) of another Trapdoor species (*Nemesia simonii* Cambridge). These appear to occur on the same spots and to be much mixed up with those of the other Spider. Considerable care therefore would be necessary in conducting the operations and observations necessary to elucidate the respective economy of the two.

Fam. Drassidæ.

Subfam. Hemiclœinæ.

Genus Platyoides Cambr.

Platyoides separata, sp. n. (Plate L. figs. 7–12.)

Adult female, length $4\frac{3}{4}$ lines.

Cephalothorax and abdomen uniformly flattened; the former is of a dark rather bright yellow-brown colour; the latter on the upper side is of a mouse-coloured black above and on the sides, the underside being of a dull greyish white. The clypeus is almost obsolete. The legs, 4, 2, 1, 3, are not very strong, the three basal joints pale yellow, the rest more or less suffused with yellowish brown; and there is a thin scopula of racquet-shaped hairs on the tarsi and part of the metatarsi of the first pair. The coxal and genual joints of the fourth pair are of moderate length, nearly equal together to that of the femoral joint. The cephalothorax is a little broader than long, and broadest behind, truncated before and somewhat truncate behind.

Eyes small, not greatly unequal; the hind-central pair smallest; placed in two transverse rows occupying the greater part of the width of the caput; the anterior row is straight, the posterior longest and has the convexity of its very slight curve directed backwards. The interval between the two central eyes of each row is less than that which separates them from the laterals.

Falces strong, tumid in form, divergent and porrected. Fang long, not very strong, regularly curved and tapering. Colour similar to that of the cephalothorax.

Maxillæ long, enlarged at their base, strongly constricted at the middle, enlarged again at their extremity, where they are obliquely truncated on the inner side; colour yellow-brown.

Labium nearly as broad as high, with a transverse suture below the middle; the apex rounded; colour of a darker hue than the maxillæ.

Sternum of a nearly regular roundish oval; colour yellow tinged with orange.

Spinners small, short, and compact. Genital aperture of very distinct and characteristic form.

A single adult female was included among a few other Spiders kindly obtained for me from East London, Cape Colony, S. Africa, by Mr. Richard Hancock, of Hadleigh, Stechford.

PLATYOIDES SIMONII, sp. n. (Plate L. figs. 13–17.)

Adult male, length 2 lines.

Though resembling it in general form and other essential characters, the small comparative size of this Spider will distinguish it at once from *P. separata*. The eyes also are more closely grouped together and rather larger.

The *cephalothorax* is pale dull yellow-brown, the normal grooves and indentations indicated by darker lines. The *legs* are pale dull yellowish, the femora, tibiæ, and metatarsi suffused with brownish.

The *abdomen*, of a short oval form and dark yellowish-brown hue, has a broad central longitudinal band or area of a pale colour, bearing a longitudinal dark central tapering stripe, with some indistinct lateral sloping or oblique dark lines on each side of its hinder extremity, and representing the normal angular bars or chevrons.

The *palpi* are short; the radial shorter than the cubital joint, with a short obliquely truncated apophysis at its extremity on the inner side. The digital joint is of moderate size and short oval form; the palpal organs well developed and complex, with spiny processes.

Hab. Cape Colony, S. Africa; kindly communicated to me through Mr. R. Hancock.

Fam. ZOROPSIDÆ.

Subfam. ZOROPSINÆ.

Genus ZOROPSIS Sim.

? ZOROPSIS RUFIPES Lucas. (Plate L. figs. 18–21.)

Olios rufipes Lucas (ad partem).

Adult female, length 6 lines.

Cephalothorax rather longer than broad, moderately and uniformly convex above, and broadly truncate in front; lateral marginal impressions at caput scarcely perceptible; colour pale yellow-brown, margins palest, with dark brown marginal line.

On each side is a broad longitudinal brown band, rather tapering forwards, and irregularly dentate along both its margins, which are darker than the rest of the band; the space between these bands is marked with several longitudinal, curved, and straight brown markings. The cephalothorax is clothed thinly with short fine dark hairs.

Eyes in two transverse rows; the posterior row considerably longer, curved, the convexity of the curve directed forwards; the anterior row very nearly straight. They are small and do not differ very greatly in size; the fore-laterals are largest, the fore-centrals smallest; the interval between the hind-centrals is upwards of double that between each and the adjacent hind-lateral eye; and the interval between the fore-centrals is, if anything, rather greater than that between each and the adjacent fore-lateral. The clypeus is low, its height little, if anything, greater than the diameter of the fore-central eyes. The four central eyes form very nearly a square whose anterior side is shortest.

Legs long, 4, 1, 2, 3, apparently laterigrade (though this is partly if not entirely from the distortion of the specimen), tolerably strong, furnished with numerous spines of different lengths and strength, those of the first and second pairs mainly in two parallel rows underneath, five pairs of spines (sessile) beneath the tibiæ and four pairs, more prominent and some stronger, beneath the metatarsi. A scopula beneath the tarsi and metatarsi of the 1st, 2nd, and 3rd pairs; all end with a small but compact claw-tuft. All the tarsi are short, but of uniform length. The calamistrum is very indistinctly indicated on the metatarsi of the 4th pair. The colour of the legs is similar to that of the cephalothorax, and they are marked rather irregularly with spots and other dark brown markings, those on the femora having a tendency to obscure annulation.

The *palpi* are similar in colour and markings to the legs.

Falces strong, straight, a little indistinct backwards, towards the sternum, and of a yellow-brown colour.

Maxillæ and *labium*. These were too much concealed by a contraction over them of the adjacent parts to allow of their special form to be ascertained.

The *sternum* is small, apparently oval, and of pale dull yellowish-brown hue.

Abdomen much shrunken, but appeared to be oval; very similar in colour to the cephalothorax, marked with dark brown markings, and forming a pattern of which the following might be traced: a longitudinal short dark central broken band on the fore part, indicated by some pale marginal hairs, some oblique lateral lines on each side, and on the hinder half of the upper side two converging rows of dark spots representing the extremities of some obscure angular lines or chevrons. The under side is similar in general colour to the upper, and is slightly marked with dark brown. The genital aperture is of a very distinct and characteristic form, though much obscured by long hairs; spinners short, compact, and of ordinary form. *Cribellum* transverse, linear, subdivided, very narrow and indistinct.

An adult female was found among bananas imported from the Canary Islands and kindly sent to me by Mr. H. Speyer of Reigate. Unfortunately it had been allowed to get dry and much shrunken before it reached me, and this has rendered its minute description to be to some extent imperfect. Mons. Simon, however, suggests that it is of the species to which I have here relegated it.

Zoropsis maculosa, sp. n. (Plate L. figs. 22–24.)

♀ Adult female, length $4\frac{1}{2}$ lines; an immature male nearly $5\frac{1}{2}$ lines.

Cephalothorax longer than broad, truncate before; the lateral margins at the caput moderate. The profile runs in a nearly even and rather descending line from the beginning of the hinder slope (which is rather abrupt) to the ocular area. The height of the clypeus is scarcely more than equal to the diameter of the fore-central eyes. Colour dull yellowish, with two longitudinal indistinct yellow-brown bands, one on each side, leaving a broad central one between them. These bands are chiefly indicated by lines or narrow stripes of yellow-brown converging to the thoracic indentation; there is also a short deep brown or black line on the margins of the thorax opposite to the basal joint of each leg.

Eyes in normal position, those of the hinder row largest, the row is strongly curved, the convexity of the curve directed forwards, and the hind-central pair are nearer to each other than each is to the adjacent hind-lateral eye; the hind-laterals are largest; the anterior row is shortest, and curved in a similar direction to the hinder row, but very much less curved. The fore-central eyes are very small, and rather nearer together than to the fore-laterals.

Legs moderate in length and strength, 4, 1, 2, 3, 4 and 1 being very nearly of equal length. They are of a similar colour to the cephalothorax, more or less speckled with small dark and lighter spots, from which on their upper sides spring short fine spines; beneath the metatarsi and tibiæ of the first two pairs are two parallel rows of long sessile spines; five pairs of spines beneath the tibiæ and four pairs beneath the metatarsi. I could see no trace of the "calamistrum." Tarsi short and ending with a small compact claw-tuft.

Falces rather long, strong, straight, tapering; colour yellow-brown.

Maxillæ and *labium* similar in colour to the falces.

Sternum oval, pointed behind; pale yellow in colour.

Abdomen pale yellow-brown, thinly clothed with short fine hairs, minutely speckled with dark brown or blackish, and with some short black linear markings forming two longitudinal parallel rows in the middle of the fore half of the upper side, and six forming two converging lines on the hinder half to the spinners; each of these linear black spots has a small tuft of pale hairs outside it, and the minute black specklings form oblique lines on each side, where also are traces of oblique pale lines. Spinners short, compact, inferior pair strongest. *Cribellum* transverse, subdivided, linear, but very indistinct.

It was not quite apparent whether this female was adult, but if so the genital aperture is very simple; if not that would account for the rather larger size of the immature male which accompanied it.

The two examples above referred to were imported from the Canary Islands in packages of bananas, and kindly sent to me by Mr. H. Speyer. I am unable to detect the calamistrum in either of the two specimens above mentioned, and the cribellum is very slightly indicated. Both the calamistrum and cribellum are far less developed in some other species of this genus than in other families, and very possibly one or both may, in some instances, be almost if not quite obsolete in some species of the genus.

Fam. THERIDIIDÆ.

Genus TEUTANA Sim.

TEUTANA NOBILIS Thor. (Plate L. figs. 25–28.)

Lethyphantes nobilis Thor. Kongl. Svenska Vetenskaps-Akad. Handl. 1875, Bandet 13, no. 5, p. 338.

Adult female, length $5\frac{2}{3}$ lines.

Cephalothorax dark reddish brown. Caput in some examples much darker, with a narrow dull pale marginal line or border. The height of the clypeus considerably exceeds half that of the facial space.

Eyes subequal, in two transverse lines, forming three well-separated groups. Those of each lateral group, or pair, contiguous and seated on a strongish tubercle. The four central eyes form a square whose posterior side is shortest.

Legs moderate in length and strength, 1, 4, 2, 3, of an orange-yellow colour. The fore extremities of the tibiæ are a little suffused with reddish brown, and furnished pretty thickly and uniformly with short fine hairs.

Palpi similar to the legs in colour.

Falces strong, straight, vertical, conical, and of a deep rich red-brown colour, like that of the cephalothorax.

Maxillæ, *labium*, and *sternum* rather lighter coloured than the cephalothorax; the *sternum* longer than broad, rather triangular heart-shaped; covered with numerous minute granulations and short fine dark hairs.

Abdomen large, oval, very convex above, of a dull pale yellowish white, the white being occasioned by a more or less dense sprinkling of white cretaceous mottling; on each side of the upper side is a broad longitudinal deep brown or blackish band, the two converging at both the fore and hinder extremities, and each divided transversely into somewhat quadrate but irregular patches; in some examples these patches run together. The broad pale band between those at the sides is marked more or less with some dark lines and markings. The sides of the abdomen are also marked on the hinder half with dark brown spots, forming more or less distinct oblique lines. The under side of the abdomen has near the middle two short, parallel, broken, dark brown lines. The spinners are normal, short, compact, and of a dull brownish colour. The genital aperture small, but of characteristic form.

Several examples of the female of this fine species were contained among other Spiders imported in packages of bananas from the Canary Islands, and kindly sent to me by Mr. H. Speyer. *Steatoda clarkii* Cambr., found many years ago in Devonshire by the late Mr. Hamlet Clark, is of this species (*cf.* Proc. Dorset F. Club, xx. p. 6, sub *Teutana nobilis* Thor.).

TEUTANA GROSSA C. L. Koch.

Theridion versutum Bl., 'Spiders of Great Britain and Ireland,' p. 193.

Adult females of this Spider were included among those imported in the packages of bananas from the Canary Islands before referred to. The species has been long known to have occurred in England, and would very probably be met with more frequently on the Devon and Cornwall coasts. It does not appear to be rare in the island of Guernsey, whence I have recently received adult males of it.

Fam. GASTERACANTHIDÆ.

Genus PASILOBUS Sim.

PASILOBUS INSIGNIS, sp. n. (Plate L. figs. 29–31.)

Adult female, length 15·5 mm. ($7\frac{1}{2}$ lines); length of abdomen 11 mm., width 24 mm.

Cephalothorax short, broad; lateral indentations at the caput very strong. Caput broadly truncate before, with strong prominences bearing the central and lateral groups of eyes; height of clypeus equals half that of the facial space; a strongish conical eminence just at the hinder part of the occiput. Surface rather rugose, colour dark yellowish brown.

Eyes small, in three widely separated groups, the central four, nearly of equal size, form a rectangle a little longer than broad; those of each lateral pair are very small, contiguous, and not easy to discern.

Legs short, moderately strong, not differing greatly in length, 1, 2, 4, 3, furnished with hairs only; the tibiæ of the first and second pairs with a few small prominences, giving them a slightly rugose appearance; colour yellow-brown, very similar to that of the cephalothorax.

Falces short, powerful, conical, roundly prominent near their base in front. Similar to the legs in colour.

Abdomen rather more than twice as broad as long, of a somewhat transverse oblong form; its fore margin strongly emarginate; its upper margin is surrounded with tubercular conical or subconical prominences of different sizes, all, excepting those on the hinder margin, more or less confluent, the largest are on the lateral margins; the upper surface also has other similar prominences symmetrically disposed. There are also on the upper side numerous orange-red round sigillæ, each with a dark blackish or deep red-brown pupil; these sigillæ form a submarginal border and a symmetrical pattern in the middle; a small symmetrical pattern of minute roundish cream-yellow spots of different sizes and margined narrowly with black occupies the centre of all. The whole upper surface is dull yellowish, with a large very irregular jet-black patch on each side of the hinder part, which does not, however, obscure the orange-red sigillæ. The under side is dark yellow-brown on the hinder half, the anterior portion being black covered with small yellow irregular spots and scratch-like markings. The genital aperture is of simple but characteristic form. Spinners short, compact, situated within a circular slightly raised rim.

Sternum shield-shaped, longer than broad, with eminences opposite to the insertion of the legs. Colour dark reddish yellow-brown.

Received from Old Calabar, whence it was kindly sent to me by Mr. Holland, of the Botanic Gardens, Old Calabar.

Fam. Thomisidæ.

Genus Thomisus Walck. (ad partem).

Thomisus malevolus, sp. n. (Plate L. figs. 32–34.)

Adult female, length 9·05 mm.

General colour pale yellow with white markings and mottlings.

The *cephalothorax* has on each side a broad longitudinal band throughout its length of yellow-brown; the caput, which has the usual horned shape above, is rather symmetrically streaked with lines of white granulosities and suffused with white at the occiput behind the eyes; and the ocular area is white, margined with a strong black line, forming a large triangle, whose apex (in front) forms an acute angle almost touching the lower margin of the clypeus. This triangle is subdivided by two short curved black lines, running through the fore-central eyes and uniting at the middle of the hinder side of the triangle, which runs to the extremity of each horn. The height of the clypeus equals half that of the facial space.

The *eyes* are small, widely spread, occupying the whole width of the black triangle above described. Those of the fore-central pair are nearer together than to the fore-laterals, while those of the hind-central pair are rather further apart than from the hind-laterals; these last are placed beneath the tips of the horns of the caput, and are not easy to be seen.

Legs strong, 1, 2, 4, 3, pale yellow, mottled more or less in front with white; each of the femora of the first pair has in front a conspicuous black spot, margined with white, and two other similar spots (of which one is large and oval) on the front of the tibiæ. The tibiæ also of the second pair are similarly marked. Beneath the metatarsi of the first and second pairs is a double (parallel) row of short spines in 6 or 7 pairs. The fore extremity of the tarsi and metatarsi of the two pairs is suffused with yellow-brown.

Falces pale yellow, much suffused with white in front.

Abdomen much broader behind, where on each side is an obtuse subconical prominence; colour whitish, a little suffused with pale yellow-brown at the middle of the upper side in front, and on the sides in front are numerous minute granulosities. A short yellow-brown streak runs from the summit of each abdominal prominence inwards, and the hinder part of the abdomen is strongly and transversely rugulose. The genital aperture is of simple form, but characteristic.

This Spider is closely allied to *Thomisus anthobius* Pocock, but appears to differ from it in the position of the triangle on the ocular area, the markings of the cephalothorax and abdomen, the spotted legs of the first two pairs, and the form of the genital aperture. It is also much smaller than *T. anthobius*.

Hab. Cape Colony; received through Mr. T. Hancock.

Genus Philodromus Walck.

Philodromus punctigerus, sp. n. (Plate L. figs. 35–37.)

Adult female, length $3\frac{1}{2}$ lines.

Cephalothorax moderately convex above, though of a flattened form, pale yellow-brown, with a broad submarginal darker band on each side; margins white. Ocular area marked with white, of which colour some fine streaks run backwards just between and behind the hind-central eyes; behind this at the hinder part of the caput and just in front of the thoracic indentation is a somewhat crescent-shaped white marking, whose convexity is directed backwards (in the male this marking is of a subangular form). The height of the clypeus is a little less than half that of the facial space.

The *eyes* are small, normal; those of the hind-central pair are further from each other than from the hind-laterals; those of the anterior row also show the same relative position.

The *legs* are long, slender, second pair longest; all furnished with fine black spines and short fine hairs; they are pale yellow, minutely speckled with dark brownish.

Falces, *maxillæ*, and *labium* pale yellow-brown.

Sternum pale yellow.

Abdomen broader behind, where it is pointed, than before, where it is truncate; it is somewhat rugulose longitudinally; its colour is pale brownish, ringed with white and thickly covered with minute dark specks. The middle of the upper side shows the ordinary four impressed spots in a quadrangle longer than broad, and whose fore side is shorter than the hinder side. Between these spots and the spinners are several slender, broken, angular lines or chevrons, formed by some of the dark specks mentioned above. In an immature female there appeared something of a more or less regular whitish pattern along the middle of the upper side, with yellow-brown lateral spots and markings. Probably this pattern would become more definite in a series of examples. The underside is of a pale, dull whitish hue. The genital aperture is small, but characteristic.

An *adult male* measured a little over 2 lines in length. The cephalothorax of this sex is flatter and the abdomen is more rugulose, but in general colours, markings, and other respects it closely resembles the female; its legs, however, are much longer.

Palpi similar to the legs in colour. Cubital and radial joints equal in length; the latter has a very small pointed apophysis at its fore extremity outside; the digital joint is very narrow, scarcely broader than the radial. The palpal organs very simple and inconspicuous.

An adult male and female and an immature female were found among bananas imported from the Canary Islands, and kindly sent to me by Mr. H. Speyer.

Fam. PISAURIDÆ.

Genus EUPROSTHENOPS Pocock.

(This generic name was substituted in 1897 by Pocock for *Podophthalma* De Brito Capello, preocc., 1866.)

EUPROSTHENOPS PROSPICIENS, sp. n. (Plate L. figs. 38–40.)

Adult male, length 7 lines.

Cephalothorax longer than broad; lateral marginal impressions at caput strong, lower corners of caput produced into two strongish obtuse prominences, each bearing an eye. Cephalothorax rather flattened, the caput and thorax being on the same level; the fore part of the caput sloping forwards to the prominent corners; the normal grooves and indentations are strong; colour yellow-brown, narrowly margined with black, and with a broad dark yellow-brown longitudinal band on each side of the median line, and a narrower lateral band between it and each lateral margin, more or less densely clothed with short adpressed white hairs, which also run more or less through to the corner prominences; these last are strongly margined with deep reddish brown on their inner sides.

Eyes in two groups: four behind form a large quadrangle, the anterior side of which is much the shortest, and four in front (of which the two anterior ones are very wide apart at the extremities of the corner prominences) of the caput, and the posterior ones near together in front of the fore eyes of the hinder group, All are small, those forming the hinder side of the front quadrangle smallest.

The *legs* were too much damaged (in fact, only one of the first pair was intact) to admit of any proper description; their relative length apparently 1, 2, 4, 3. They are long and slender, of a dark yellow-brown colour, and showed signs of having been furnished with long fine spines.

Palpi moderately long, dark yellow-brown, furnished on some or all of the joints with short white hairs or pubescence; but this had been much rubbed off. Cubital and radial joints short, the latter a little the longer, and with a short, tapering, slightly curved apophysis at its extremity on the outer side; the digital joint large, oval, with its fore extremity produced in a long, pointed, finger-like form, its whole length equal to that of the humeral joint; palpal organs simple, consisting of several corneous lobes, with a small, rather curved, pointed, black spine at their extremity in front.

Falces strong, straight, vertical, yellow-brown, with a broad, dark, longitudinal stripe on each side in front.

Maxillæ and *labium* black-brown, with pale, dull, yellowish extremities.

Sternum somewhat ovato-quadrate, its hinder extremity ending in a small abrupt point. Colour yellow-brown, with an obscure, central, longitudinal, blackish diffused stripe.

Abdomen long, narrow, rather tapering to spinners; yellow-brown, with a pointed spear-shaped, longitudinal, blackish central marking at its fore extremity on the upper side, edged with a pale yellowish line; sides dark black-brown, and on the under side is a longitudinal tapering band from the fore end to the spinners, edged with a fine pale line. Spinners short, convergent, the inferior pair much the strongest.

It is very probable that other parts of this Spider, as well as those noted above, were furnished with white hairs or hairy pubescence; but the bad condition of the specimen described did not permit of any exact description.

A single example was kindly sent to me by Mr. W. Falconer, of Slaithwaite near Huddersfield, having been received by him from Mashonaland, South Africa. It is nearly allied to—but quite, I think, distinct from—*E. elliottii* Cambr. (from East Central India). It is also distinct from the type species described by De Brito Capello (*E. bayoneanus*) as well as from *E. australis* Sim. (Ann. Soc. Ent. Belg. xlii. p. 12 (1898), S.E. Africa).

List of Species above noted and described.

Pachylomerus ædificatorius Westwood, p. 818, Pl. L. figs. 1–6. Lagos, Portugal.

Platyoides separata, sp. n., p. 819, Pl. L. figs. 7–12. Cape Colony.

Platyoides simonii, sp. n., p. 820, Pl. L. figs. 13–17. Cape Colony.

Zoropsis rufipes Lucas, p. 820, Pl. L. figs. 18–21. Canary Islands.
Zoropsis maculosa, sp. n., p. 822, Pl. L. figs. 22–24. Canary Islands.
Teutana nobilis Thor., p. 823, Pl. L. figs. 25–28. Canary Islands.
Teutana grossa C. L. Koch, p. 824. Canary Islands.
Pasilobus insignis, sp. n., p. 824, Pl. L. figs. 29–31. Old Calabar.
Thomisus malevolus, sp. n., p. 825, Pl. L. figs. 32–34. Cape Colony.
Philodromus punctigerus, sp. n., p. 826, Pl. L. figs. 35–37. Canary Islands.
Euprosthenops prospiciens, sp. n., p. 827, Pl. L. figs. 38–40. Mashonaland, S. Africa.

EXPLANATION OF PLATE L.

Fig. 1. *Pachylomerus ædificatorius* Westw., ♀, enlarged, without legs or palpi. 2. Profile. 3. Eyes from above and behind. 4. Extremity of tarsus of fourth pair of legs, on outer side. 5. Spinners. 6. Tibia of third pair of legs.

Fig. 7. *Platyoides separata*, sp. n., ♀, outline, enlarged, without legs or palpi. 8. Eyes from above and behind. 9. Maxillæ and labium. 10. Genital aperture. 11. Profile outline. 12. Sternum.

Fig. 13. *Platyoides simonii*, sp. n., ♂, eyes and falces from above and behind. 14. Maxillæ and labium. 15. Left palpus on outer side. 16. Cubital and radial joints of ditto from inner side. 17. Upper side of Spider without legs or palpi; enlarged.

Fig. 18. *Zoropsis rufipes* Lucas, ♀, Spider, upper side enlarged. 19. Eyes from above and behind. 20. Genital aperture. 21. Leg of second pair.

Fig. 22. *Zoropsis maculosa*, sp. n., ♀, full fig., upper side. 23. Eyes from in front. 24. Genital aperture.

Fig. 25. *Teutana nobilis* Thorell, ♀, full fig., upper side. 26. Profile. 27. Eyes from above and behind. 28. Genital aperture.

Fig. 29. *Pasilobus insignis*, sp. n., ♀, full fig., upper side. 30. Eyes and caput from above and behind. 31. Genital aperture.

Fig. 32. *Thomisus malevolus*, sp. n., ♀, upper side, without legs. 33. Eyes and ocular area from in front. 34. Genital aperture.

Fig. 35. *Philodromus punctigerus*, sp. n., ♂, full fig., upper side. 36. Eyes from above and behind. 37. Genital aperture, ♀.

Fig. 38. *Euprosthenops prospiciens*, sp. n., ♂, upper side, without legs. 39. Eyes from in front. 40. Left palpus, outer side.

2. Descriptions of new Species of South-American Beetles of the Cryptocephaline Division of the Family *Chrysomelidæ*. By the late MARTIN JACOBY, F.E.S.

[Received May 17, 1907.]

Since Suffrian's valuable monograph of South-American *Cryptocephalini* (Linn. Entom. 1863) only single descriptions of some of these immensely numerous insects have appeared. The present paper deals with those species contained in my collection which seem to be undescribed. The genera *Metallactus* and *Griburius* are so difficult to define, however, and show so little stability in their structural characters, that it matters little in which of these genera the species now incorporated are placed.

At all events the present descriptions add considerably to those forms already known from the regions in question.

A few species from some West Indian islands have been added.

Monachus picipes, sp. n.

Black and shining; basal joint of antennæ, labrum, and tibiæ and tarsi more or less piceous or fulvous; thorax impunctate; elytra strongly punctate-striate.

Length 2–2¼ millim.

Head deeply inserted in the thorax, black, impunctate, minutely granulate; antennæ with the lower four joints fulvous, rest black, strongly widened, extending to the base of the thorax. The latter twice as broad as long, strongly narrowed in front, subcylindrical, the sides nearly straight, the surface minutely granulate but not perceptibly punctured, shining. Elytra with a slight purplish gloss strongly punctate-striate at the base, each row beginning with a small fovea, apical portion nearly impunctate. Base of the femora and the tibiæ more or less fulvous or piceous. Prosternum strongly transverse, sometimes fulvous.

Hab. Peru; Colombia.

Differs from *M. nigritula* Boh. in the black, shining, not blue opaque colour of the upper surface and the want of the thoracic depression. *M. tenebricosus* Suff. is of nearly double the size and has also thoracic depressions.

Monachus mexicanus, sp. n.

Black; basal joints of the antennæ fulvous; thorax opaque, impunctate; elytra deeply punctate-striate, bluish black with a transverse oblique fulvous band at middle.

Length 2½ millim.

Of oblong-ovate shape, distinctly narrowed at apex; the head impunctate, very narrow between the eyes, emargination of the latter short but deep; lower four joints of antennæ fulvous, the rest wanting, third and fourth joints very short. Thorax proportionately long, strongly narrowed anteriorly; sides feebly rounded; basal margin simple; entire surface dull black, finely granulate, without trace of punctures. Scutellum elongate, pointed and narrow. Elytra narrowed at apex and convex, deeply and regularly punctate-striate, the punctures distinct to apex; the interstices costate at sides and slightly raised at inner disc; the surface of a more bluish colour than that of thorax and rather shining; the fulvous band broad, commencing below the shoulders, and extending obliquely to suture, which remains, however, of the ground-colour to a very small extent; upper margin of the band concave near the suture, but convex at the same place at lower edge. Body below and legs bluish black. Prosternum slightly broader than long, impunctate, its lower edge feebly emarginate.

Hab. Yantepec in Mexico.

In coloration this species agrees entirely with *M. biplagiatus* Boh., but differs in the strong elytral puncturation and raised interstices, in the shape of the prosternum and that of the general outline; there is also a difference in the shape of the elytral band.

Monachus peruanus, sp. n.

Black; anterior legs and thorax flavous, the latter with two black spots, impunctate; elytra finely punctate-striate, each with a small fulvous spot near apex.

Length 2 millim.

Head impunctate, flavous, sometimes obscure fuscous; antennæ extending to base of thorax, black, basal joint flavous. Thorax twice as wide as long; sides straight, narrowed anteriorly; surface entirely impunctate, opaque, flavous, with two elongate short black stripes at middle, widely separated; posterior margin with a row of fine punctures. Scutellum elongate and pointed, smooth, black. Elytra extremely minutely punctured, black, the punctures commencing more deeply impressed at the base; each elytron with a transverse flavous spot near apex. Prosternum, mesosternum, and the anterior and intermediate legs flavous; rest of the under side and legs black, shining, and nearly impunctate.

Hab. Peru.

Somewhat similar to *M. bicolor* Fab. and allied species, but quite distinct in the markings of the elytra, which are the same in the two specimens contained in my collection.

Monachus nigritarsis, sp. n.

Dark metallic blue; labrum fulvous; abdomen and tarsi black; thorax impunctate; elytra distinctly punctate-striate, the punctures visible to apex.

Length $2\frac{1}{4}$ millim.

Head impunctate, finely granulate, opaque; eyes rather closely approached at top; antennæ black, second and third joints small, the following ones widened, scarcely longer than broad. Thorax strongly transverse and narrowed in front; surface entirely impunctate, with a narrow short groove at the base each side near the scutellum, impressed with a few fine punctures. Scutellum elongate, pointed. Elytra twice as long as the thorax, the basal margin strongly raised, behind which each stria commences with a deep puncture; rest of the surface finely punctured, distinct to the apex. Prosternum much broader than long. Legs bluish, tarsi black.

Hab. Peru.

Differs from *M. nigritulus* Boh. in the elytral puncturation, (which is not obliterated behind), in the black tarsi, and want of row of punctures at base of thorax.

Monachus ornatipennis, sp. n.

Black; basal joints of antennæ fulvous; thorax impunctate; elytra very finely punctate-striate, each with an oblique longitudinal red band from shoulders towards suture.

Length 2 millim.

Head entirely impunctate, bluish black; antennæ with the lower five joints, fulvous, rest black, second and following joints very small, terminal joints wanting, sixth and seventh thickened Thorax subcylindrical, rather long, strongly widened at middle; surface smooth and shining, black; a narrow transverse groove in front of scutellum, finely punctured. Scutellum elongate and pointed, black, impunctate. Elytra about one-half longer than broad, the puncturation only visible under a very strong lens; shoulders and humeral lobes but feebly marked, the black colour interrupted by a broad oblique red band extending from the basal margin to below the middle and inwards as far as the first row of punctures. Prosternum twice as broad as long, fulvous as well as the mesosternum and the tibiæ and tarsi, these latter more obscurely so.

Hab. Prov. Tucuman, Argentine Republic.

Smaller than *M. pustulipennis* St., the thorax without lateral depressions, the elytral puncturation much finer, the red band extending to the base and much nearer towards the suture.

MONACHUS TERMINATUS, sp. n.

Fulvous; terminal joints of antennæ, sides of breast, legs, and apex of elytra black; thorax impunctate; elytra finely punctate-striate.

Length $2\frac{1}{2}$ millim.

Head with the middle portion fulvous; eyes occupying the entire sides; antennæ extending to base of thorax, black; lower two joints fulvous, second and following joints short, terminal ones considerably thickened. Thorax twice as broad; anterior margin half the width of posterior one; surface entirely impunctate, opaque, fulvous. Scutellum elongate, triangularly pointed. Elytra slightly narrowed posteriorly, with finely punctured rows, each row beginning with a deep puncture at base; basal margin narrowly black; rest of surface fulvous, the apex in shape of a transverse band black; sides of breast, abdomen and legs black. Prosternum fulvous, transverse, widened at posterior portion; the angles pointed.

Hab. Peru.

MONACHUS MERIDAENSIS, sp. n.

Below black; thorax fulvous, with two black spots anteriorly, impunctate; elytra bluish black, strongly punctate-striate.

Length 2 millim.

Rather broad and short; the head impunctate, blackish, opaque, lower portion more or less fulvous; antennæ very short, black, basal joint fulvous, terminal ones strongly thickened. Thorax scarcely twice as broad as long, strongly narrowed anteriorly; surface opaque, impunctate, with two small, elongate, black spots before middle anteriorly. Scutellum much longer than broad. Elytra broad at base, slightly narrower posteriorly;

basal margin narrowly raised; puncturation rather strong and distinct to apex; surface of greenish or bluish-black coloration. Prosternum fulvous, transverse. Legs black or partly fulvous.

Hab. Merida, Venezuela.

Very closely allied to *M. obscurellus* Suff., with which I cannot identify the species; the thorax has no puncturation at all and the dark spot is not placed at the middle, nor does it extend to anterior or posterior margin as Suffrian describes his species; the elytra are not finely, but comparatively strongly, punctured.

MONACHUS DIVISUS, sp. n.

Black; basal joint of antennæ fulvous; thorax extremely minutely punctured at sides; elytra finely punctate-striate, a broad transverse band at base, not quite extending to suture, bright red.

Length $2\frac{1}{2}$ millim.

Head black, entirely impunctate; antennæ black, the basal joint fulvous, very elongate, terminal ones strongly thickened. Thorax rather long, strongly subcylindrical and narrowed in front, black with æneous gloss; the sides with some minute punctures; the disc impunctate; the base with a narrow transverse sulcus in front of the scutellum; the latter broad and triangular. Elytra about twice the length of the thorax, rather strongly punctate-striate, each stria commencing with a deep puncture at the base; the interstices very finely punctured; the entire anterior half occupied by a transverse red patch or band, which at its inner lower angle is obliquely rounded and does not quite extend to the suture. Under side and legs black; femora very strongly thickened. Prosternum twice as broad as long, finely punctured.

Hab. Jalahy, Prov. Goyaz, Brazil.

Not unlike *M. babioides* Suff., but the thorax with a distinct æneous gloss, the basal joint of the antennæ very elongate, and the elytra without apical red spot. The æneous gloss of the thorax and its fine puncturation at the sides, and the much larger elytral red patch which extends to the base and nearly to the suture, separate the species from *M. pustulipennis* Stål.

STEGNOCEPHALA NIGRITARSIS, sp. n.

Dark fulvous; the antennæ (the basal joint excepted), apex of tibiæ, and the tarsi black; extreme basal margin of the elytra black.

Length $3\frac{1}{2}$–4 millim.

Oblong. Head impunctate; eyes nearly touching at base; labrum and mandibles black. Antennæ extending to the base of the thorax, black; basal joint fulvous, elongate, second very short, third and fourth nearly equal, elongate, the following joints widened, but little longer than broad. Thorax strongly narrowed anteriorly, sides nearly straight, narrowly margined; surface entirely impunctate, very shining, with a short oblique depression in front of scutellum at each side. Scutellum trigonate, foveolate at base, the latter narrowly black. Elytra with strongly produced humeral lobes, extremely finely punctured in shallow grooves; the interstices flat and impunctate. Prosternum transverse, strongly produced in front; pygidium closely and rather strongly punctured, pale fulvous.

Hab. Brazil.

This species differs from *Crypt. pasticus* Suff., to which it seems closely allied, in the black antennæ, the short thoracic depression (which does not extend to the sides), and in the black apex of the tibiæ and the similarly coloured tarsi.

STEGNOCEPHALA BASALIS, sp. n.

Fulvous; terminal joints of the antennæ and the breast black; thorax impunctate; elytra very finely punctate-striate, fulvous, the basal margin black.

Length 3–3½ millim.

Short and ovate; the head impunctate; eyes nearly contiguous in the male, more separated in the female, broadly subquadrately emarginate. Antennæ slender, extending to the base of the thorax; lower three or four joints flavous, rest black; third and fourth joints elongate, equal, following ones slightly thicker and shorter. Thorax nearly twice as wide at the base as anteriorly, strongly widened at the middle, lateral margins nearly straight posterior angles acutely produced; median lobe scarcely marked; surface entirely impunctate, the anterior portion slightly darkened, obscure, basal portion paler fulvous. Scutellum broadly trigonate, obscure fulvous, impunctate. Elytra slightly narrowed posteriorly, extremely finely punctured except near the basal margin, where the rows commence with a deep impression; interstices flat, impunctate, the last outer one slightly convex; the base narrowly black, in shape of a transverse band extending across the shoulders and downwards along the margins to a slight extent. Breast more or less black; prosternum broader than long, anterior margin concave.

Hab. Amazons.

Of nearly similar coloration as the variety of *S. discoidalis* Baly, but distinguished by the entirely impunctate thorax and the finely punctured elytra, even when seen under the strongest lens. Five similar specimens are contained in my collection.

CRYPTOCEPHALUS PERUANUS, sp. n.

Black; thorax impunctate; elytra finely punctate-striate.

Length 3 millim.

Oblong, slightly narrowed posteriorly; the head finely granulate-punctate, opaque; eyes triangularly emarginate; antennæ rather short, black, basal joint fulvous below, long and slender, third and fourth equal, the following joints slightly triangularly widened. Thorax rather long, about one half broader than long, sides feebly rounded and narrowed in front; hind angles acute but not produced; surface entirely impunctate. Scutellum rather long and pointed. Elytra with the basal margin carinate, the punctures stronger at base than posteriorly, each row commencing with a deep foveolate puncture. Legs elongate; anterior femora thickened, their tibiæ widened at the apex.

Hab. Peru.

Of somewhat *Monachus*-like shape and well distinguished by the entirely black coloration, finely granulate head, &c. The prosternum is subquadrate, with the posterior margin truncate.

CRYPTOCEPHALUS OLIVACEUS, sp. n.

Olive-green; basal joints of antennæ, under side, and legs flavous; thorax impunctate; elytra finely punctate-striate.

Length 5-6 millim.

Subcylindrical and parallel. Head pale green, the vertex with a deep depression and a few fine punctures only; clypeus distinctly separated from the face, more distinctly punctured, margined with obscure flavous; eyes broadly and subquadrately emarginate; mandibles black; antennæ extending to middle of elytra, black, lower three joints flavous, third and fourth equal, fifth and following joints much longer. Thorax subconical, strongly narrowed in front; sides nearly straight, posterior margin oblique at each side, median lobe strongly produced; surface entirely impunctate, olive-green, extreme basal margin pale piceous. Scutellum obscure flavous. Elytra finely punctate-striate, with a very feeble depression below the base, interstices slightly wrinkled anteriorly; extreme sutural margins piceous. Below and the legs as well as the pygidium flavous; prosternum broad, sparingly punctured, posterior margin subtriangular.

Hab. Jalahy, Prov. Goyaz, Brazil.

Much distinguished by its green and flavous coloration, rare amongst the numerous members of this group, but evidently allied to *C. alliaceus* Kirsch, from Peru, in coloration, but in that species the head is flavous and the elytra are banded.

CRYPTOCEPHALUS FOVEICOLLIS, sp. n.

Fulvous; antennæ and legs (base of femora excepted) black; thorax impunctate, sides with a foveolate sulcus; elytra strongly and closely punctate-striate.

Length 4 millim.

Elongate and narrow; sides and upper portion of the head entirely occupied by the eyes, which meet at the vertex; clypeus separated from the face by a deep semicircular groove, sparingly punctured as well as the intraocular space; antennæ slender, black, lower two joints fulvous, third and fourth joints equal, much shorter than the following ones, these scarcely thicker. Thorax about one half broader than long, much narrowed in front, lateral margins oblique and straight; surface impunctate, the anterior portion strongly convex, the posterior with a curved sulcus, which commences at the middle of the lateral margin and ends in a deep fovea in front of the posterior angles, these acute and produced, another more shallow depression is placed at each side near the scutellum; extreme edge of posterior margin black. Scutellum narrowly elongate and pointed, fulvous, base with a small fovea. Elytra parallel and elongate, with a very shallow depression below the base, very closely punctate-striate; the punctures transverse, much finer near the apex; the interstice at the shoulders costiform; epipleural lobes rather strongly produced. Under side paler; legs elongate, black, the base of the femora fulvous, claws appendiculate. Prosternum longer than broad, with shallow lateral grooves, posterior margin straight.

Hab. Bahia.

A very aberrant species and agreeing almost with the genus *Mastacanthus* Suff., but the prosternum of different shape. Having only a single specimen for comparison, I have included it at present in *Cryptocephalus.*

CRYPTOCEPHALUS EMARGINATUS, sp. n.

Fulvous; antennæ and sides of breast black; thorax impunctate; elytra finely punctate-striate, fulvous, the extreme basal margin black, outer interstices costate.

Length 3 millim.

Broadly ovate; head impunctate, sides and vertex entirely occupied by the eyes, which are only separated by a very narrow space; antennæ extending to middle of elytra, black, basal two joints fulvous, third and fourth joints elongate, equal, following joints shorter and thicker. Thorax strongly narrowed anteriorly, twice as wide at the base than in front, the sides straight; surface shining and impunctate, the basal portion paler than the anterior one. Scutellum triangular, fulvous, base black. Elytra with fine rows of punctures distinct to the apex, the fifth and sixth rows shortened and joined at the apex, third and ninth rows similarly connected; the extreme basal margin black, this colour also extending to the epipleuræ of the humeral lobes, the extreme sutural and apical margins likewise black; interstices impunctate, the outer two longitudinally convex. Breast more or less black. Prosternum broadly subquadrate, with some irregular depressions.

Hab. Amazons.

Of short and broad shape, the puncturation of the elytra very fine, the latter with the basal margin and epipleuræ black. I have two exactly similar specimens before me. The species bears the above specific name in the Brit. Mus. collection, but I can find no species so described.

CRYPTOCEPHALUS BAHIAENSIS, sp. n.

Reddish-fulvous, shining; head, underside and legs flavous; antennæ with apical joints black; thorax impunctate; elytra finely punctate-striate.

Length 3 millim.

Rather short and broad; the head impunctate; eyes subtriangularly notched, nearly touching at vertex; antennæ slender, lower four joints testaceous, rest black, third and fourth equal, elongate, terminal joints slightly widened. Thorax about one half broader than long, basal margin about twice as wide as anterior one, sides nearly straight; surface entirely impunctate, reddish-fulvous, anterior margin slightly flavous. Scutellum trigonate, basal margin black. Elytra slightly narrowed towards apex, without depression, finely and regularly punctate-striate, the punctures slightly larger at anterior portion; last two or three interstices feebly convex; colour similar to that of thorax, extreme basal margin black. Under side and legs flavous. Prosternum subquadrate, the lateral margins raised, base truncate.

Hab. Bahia.

Not unlike *C. bisulcatus* Suff. in coloration, but with entirely flavous legs and finely, not coarsely punctured elytra, interstices smooth.

CRYPTOCEPHALUS TUCUMANENSIS, sp. n.

Flavous; thorax nearly impunctate, pale brownish, sides, a central longitudinal band, and two obscure spots at base flavous; elytra very finely punctate-striate, flavous, an elongate subquadrate band across suture extending below middle obscure dark brownish.

Length $1\frac{2}{3}$ millim.

Very narrowly elongate, subcylindrical, subopaque. Head flavous with a brownish central band, impunctate; eyes feebly emarginate, widely separated at vertex (♀?); lower three joints of antennæ flavous, rest wanting. Thorax scarcely twice as broad as long; sides nearly straight, but little narrowed anteriorly; surface microscopically punctured and granulate, flavous; a broad pale brown band each side near middle includes a small spot of the ground-colour at the base. Scutellum narrowly elongate, nearly black. Elytra twice as long as the thorax, very finely punctate-striate, with a few extra punctures below the shoulders; interstices flat, minutely granulate, the last one widened; the ground-colour pale yellow; the humeral callus and an elongate sutural band from base to below middle pale piceous. Below and the legs entirely flavous. Prosternum longer than broad, feebly emarginate at posterior margin.

Hab. Tucuman, Argent. Rep.

This extremely small species seems more nearly allied to *C. miserabilis* Suff. than others, but is of different coloration and well distinguished (as far as the single specimen before me admits) by the sutural piceous elongate band, also by the almost invisible puncturation of the thorax.

In the La Plata Museum and that of my own. The following species from the same locality may possibly be a variety of this one or represent the other sex.

Cryptocephalus acuminatus, sp. n.

Flavous; terminal joints of antennæ and the breast black; thorax finely granulate, an obscure broad ⌒⌒-shaped mark at middle pale brownish; elytra finely punctate-striate, the punctures piceous.

Length $1\frac{1}{2}$ millim.

Larger and more robust than the preceding; the head as in that species; last six joints of the antennæ thickened, only extending to base of elytra. Thorax with straight lateral margins, the posterior angles strongly produced and pointed; surface minutely granulate, with a broad and obscure brownish ⌒⌒-shaped mark so frequently met with in the group; this design includes three flavous spots at the base and another one near anterior margin at middle. Elytra cylindrical, distinctly punctate-striate; all the punctures piceous and distinct to apex, the seventh row only indicated at base, entirely wanting below the shoulders, the corresponding interstice on this account much wider than the others and as wide as the last two. Breast black; abdomen piceous at base.

Hab. Tucuman, Argent. Rep

There seem to be sufficient differences to separate this species from the preceding, the more so as another similar specimen is contained in the La Plata Museum.

Cryptocephalus bivitticollis, sp. n.

Flavous; base of head, antennæ, and tarsi black; thorax remotely punctured, with two black bands; elytra closely punctate-striate anteriorly, each elytron with a subsutural and lateral narrow band and suture black.

Length $4\frac{1}{2}$ millim.

Head with a few punctures at vertex, the latter in shape of a narrow transverse band, black, another small black spot in front of each eye; middle of head with a deep short groove which extends to clypeus, the latter very strongly and closely punctured; antennæ with second and third joints flavous below, rest black, third joint half the length of fourth, following four elongate, rest wanting. Thorax strongly subcylindrical, long, scarcely one half broader than long; sides rounded, rather suddenly constricted in front; surface strongly and remotely placed at sides and near anterior margin, flavous, each side with a straight, black, narrow band near middle, from base to apex, basal margin strongly thickened. Scutellum black, broad, truncate at apex. Elytra rather short and broad, rather finely punctured in semiregular, not very closely placed rows from base to middle; punctuation very obsolete near apex; the suture narrowly and two broader bands from base nearly to apex black, the first band commences from middle of base and the second is placed close to lateral margins. Below flavous, a spot at outer side of femora, extreme apex of tibiæ, and the tarsi black. Prosternum broad, rugosely punctured, pubescent, basal margin straight.

Hab. Argentine Rep.

Somewhat allied in coloration to *C. 4-vittatus* Jac. from Central America, but distinguished from that and some other species by the proportionately long thorax and its two black bands.

CRYPTOCEPHALUS FLOHRI, sp. n.

Above yellowish white; the head with two, the thorax with four longitudinal brown bands; elytra strongly punctate-striate, the alternate interstices pale brownish.

Length $3\frac{1}{2}$ millim.

Head nearly white, with a central brown stripe which divides anteriorly into two branches, this portion distinctly punctured, rest impunctate; eyes very broadly but not deeply notched; clypeus transverse, deeply triangularly emarginate, the base with a narrow transverse brown stripe; antennæ extending just below the base of the elytra, black, the lower four joints fulvous, third and fourth equal, each shorter than the fifth joint. Thorax twice as broad as long, the lateral margins nearly straight, anterior one about half the width of the posterior; surface sparingly and extremely finely punctured, coloured like the head, with four slightly curved ferruginous bands from base to apex, of nearly equal width and distance, the two middle ones nearly touching at the base and not quite extending to the anterior margin, the lateral bands with a very narrow short stripe at middle branching off at right angles outwards. Scutellum yellow, margined with black. Elytra narrow and parallel, strongly and regularly punctate-striate, the seventh row interrupted below the shoulders and closely approached to the eighth row, second row united with the ninth at the apex; the interior of all the punctures dark brown; the third, fifth, and seventh interstices pale fulvous; humeral callus likewise dark brown, extreme sutural margins nearly black. Breast and abdomen dark brown, strongly rugose-punctate; femora and tibiæ likewise brown; a spot at the apex of the femora, anterior coxæ, upper portion of the breast, a subquadrate spot at the metasternum, and the pygidium yellowish white, the latter strongly punctured.

Hab. Guanajuato, Mexico.

A very prettily marked species, of which I received a specimen from the late Mr. Flohr, too late for description in the 'Biologia Centr.-Americana.'

CRYPTOCEPHALUS APICIPES, sp. n.

Pale fulvous; the antennæ, apex of the tibiæ, and the tarsi black; thorax with a deep semicircular groove at the posterior angles, impunctate; elytra finely punctate-striate.

Length 4 millim.

Head slightly rugose or uneven; the large eyes deeply subquadrately emarginate, the emargination placed at the middle; clypeus wedge-shaped, broad, impunctate; antennæ black, the basal joint fulvous, robust, fourth and following joints gradually and strongly widened, elongate, the terminal joint nearly extending to the apex of the elytra. Thorax about one half broader than long, strongly narrowed in front; sides rounded; disc very convex, bounded at the sides by a deep, nearly semicircular groove, which surrounds the anterior angles, but is continued at the base to the scutellum; surface entirely impunctate; extreme basal margin black. Scutellum narrowly elongate; its apex truncate, impunctate. Elytra with strongly pronounced epipleural lobes, slightly narrowed posteriorly; the shoulders tuberculiform; the surface finely punctate-striate, the punctures at the sides rather stronger; interstices flat and impunctate. Under side slightly paler; legs robust; tarsi very broad. Prosternum widened posteriorly; the margin slightly emarginate or concave.

Hab. Jalahy, Prov. Goyaz, Brazil.

This is a very aberrant species, and recalls an Australian representative of the genus rather than a New World form; I know no similarly structured species from that region. I received a specimen from M. Donckier at Paris, and I have no reason to doubt the correctness of the locality. The strong thoracic sulcus, dilated antennæ, and structure of the eyes characterize the species most decidedly.

CRYPTOCEPHALUS SEMIOPACUS, sp. n.

Head, antennæ, thorax, and legs fulvous, elytra dark blue; thorax finely rugosely punctured; elytra strongly punctate-striate, the interstices finely transversely wrinkled; breast and abdomen black.

Length 4 millim.

Elongate and parallel; the head very deeply, subconfluently punctured, fulvous; eyes very broadly, subquadrately emarginate; clypeus impunctate, transverse, well separated, its anterior edge, as well as the labrum, piceous; antennæ extending to the middle of the elytra, flavous, terminal joints fulvous, third and fourth equal, fifth longer, the following gradually shortened. Thorax twice as broad as long, distinctly narrowed anteriorly; sides feebly rounded; surface fulvous; the posterior angles flavous, strongly produced; entire disc finely rugosely punctured. Scutellum black, short. Elytra elongate, finely punctate-striate near the suture, the first three or four rows regular and well separated, the outer rows much more closely approached and irregular, the last two rows with deeper punctures at the basal portion; all the interstices extremely finely transversely wrinkled, of silky appearance. Pygidium black, closely punctured; legs fulvous, rather slender; under side black. Prosternum fulvous, elongate, narrowed at middle; posterior margin with strongly produced angles.

Hab. Mexico.

This is a well marked and distinguished species, of which I know a single specimen only, received from M. Donckier at Paris. The coloration and characteristic sculpturing of the elytra differ from any other Central-American *Cryptocephalus* with which I am acquainted.

CRYPTOCEPHALUS GUIANAENSIS, sp. n.

Pale flavous; antennæ (the basal joints excepted) black; head coarsely punctured; thorax with a very deep, foveolate sulcus at each side, impunctate; elytra deeply and closely punctured, with rugose and costate interstices.

Length 5 millim.

Elongate and parallel, the head with a row of punctures near the eyes, rest impunctate; eyes deeply subquadrately emarginate at middle, rather closely approached at the vertex; antennæ extending beyond the middle of the elytra, black, the lower three joints flavous, third and fourth joints equal, fifth as long as the preceding two together, the following nearly equally long and thickened. Thorax quite twice as broad as long; the sides less strongly deflexed than in most species; lateral margins nearly straight, moderately strongly narrowed in front; surface impunctate and shining, flavous; from the middle of the lateral margins runs a deep, sinuate sulcus to the base in front of the scutellum, at the middle this sulcus is widened into a fovea, the space which lies behind is strongly raised, especially so near the posterior angles; in front of the scutellum this sulcus ends in another fovea. Scutellum narrow and elongate, almost subcylindrical. Elytra convex, very slightly narrowed posteriorly, with rows of deep, foveolate punctures, extremely closely placed and almost confluent, the interstices transversely rugose and longitudinally costate, the punctures near the apex finer and more separated. Legs elongate, flavous. Prosternum broadly subquadrate, strongly produced in front, base feebly emarginate.

Hab. British Guiana.

I know no other South-American *Cryptocephalus* with an equally deeply sulcate thorax or similar elytral sculpture.

CRYPTOCEPHALUS GUNDLACHI, sp. n.

♀. Purplish blue; thorax finely punctured with wrinkled interstices; elytra strongly punctate-striate, a transverse band at base; the sides below the shoulders and the apex flavous.

Length 5 millim.

Of broad and somewhat flattened shape; the head strongly and rather closely punctured, purplish blue; labrum and mandibles black; antennæ purplish, lower three joints more or less fulvous below, fifth and following joints very elongate, longer than fourth. Thorax more than twice as broad as long, not much narrowed anteriorly, the sides rounded, posterior angles produced; the entire surface finely wrinkled, sparingly and very finely punctured; median lobe very short, scarcely produced. Scutellum black, oblong, impunctate. Elytra strongly punctate-striate anteriorly, finely so towards the apex, the rows widely separated; the interstices very finely wrinkled, with a transverse smooth raised space at the sides below the shoulders, the punctures in front of this space interrupted; the base in shape of a transverse band extending downwards at the sides to below the middle and the apex, pale fulvous, rest of the disc purplish blue. Below and legs of the latter colour. Prosternum strongly produced in front, deeply bilobed posteriorly.

Hab. Havana.

Whether this is the female of *C. grossulus* Oliv., the male of which was described at length by Suffrian, I do not know, but the coloration is entirely different. The thorax has no yellow margins, nor have the elytra a flavous band at middle; they may be described as fulvous with the entire disc purplish blue, this colour assumes the shape of a broad band which is strongly emarginate at the sides; the colour of the body below and that of the legs also differs from Olivier's species.

Cryptocephalus cubaensis, sp. n.

Body below dark brown, above metallic dark blue; thorax impunctate; elytra very deeply and closely punctured, a transverse spot at the base and a narrow band at the middle flavous.

Length 4 millim.

♀. Elongate, the head nearly impunctate, metallic blue; clypeus fulvous; eyes subtriangularly notched; antennæ long and slender, lower five joints fulvous, rest dark, fifth and following joints longer than fourth. Thorax scarcely more than one-half broader than long, narrowed anteriorly, sides rounded, median lobe scarcely produced; surface entirely impunctate, blue. Scutellum elongate and narrow. Elytra with very deep and closely approached rows of punctures, which only slightly diminish in size towards the apex; the last two interstices costate, the others slightly wrinkled near the shoulders; the blue ground-colour interrupted by a transverse flavous spot near the scutellum at the base and by another oblique narrow band at the middle near the suture, not extending to the sides. Body below and legs dark fulvous. Prosternum longer than broad, posterior margin feebly concave.

Hab. Cuba.

Differs in coloration from any other species from the same locality.

Cryptocephalus semifasciatus, sp. n.

Black; thorax fulvous, minutely punctured; elytra ferruginous, deeply and closely punctured, a spot below the base, another near the apex, and an interrupted transverse band across suture below middle, black.

Length 4 millim.

Subcylindrical and parallel; head black, closely punctured and finely pubescent; labrum fulvous; eyes broadly emarginate at middle; antennæ long and slender, black, basal four joints fulvous, first piceous above, third and fourth equal, fifth longer, Thorax subglobular, not much narrowed in front, posterior margin about one-half wider than anterior one, sides rather rounded; surface extremely closely and finely punctured, dark fulvous, extreme posterior edge black; posterior angles acute, but not produced. Scutellum black, not longer than broad, impunctate. Elytra parallel-sided, more yellowish in colour than the thorax, without basal depression, very deeply and closely punctate-striate, punctures scarcely finer at apex; interstices more or less transversely rugose, the outer ones and those near the suture and apex costate; subsutural short row of punctures extending to middle, first row below the latter, second row nearly joined to ninth at apex, third and fourth similarly connected, the following two rows abbreviated near apex. Body below and the legs black, finely pubescent; a small black spot below base near suture on the third row of punctures; a transverse, slightly oblique, black band, not extending to the margins, but across suture below middle, and a larger black spot between the fourth and eighth rows of punctures at their apex.

Hab. Mexico.

I only know a single specimen of this species (♂), well distinguished by the black head and body, the deep and close punctures of the elytra and their design.

Cryptocephalus subænescens, sp. n.

Fulvous; thorax with æneous gloss; elytra dark metallic greenish, very finely punctured; breast and abdomen black.

Length $1\frac{1}{2}$ millim.

Narrowly elongate, the head impunctate, fulvous; eyes slightly sinuate only; antennæ pale fulvous, terminal three joints slightly darkened, third and following joints gradually widened. Thorax subglobular, about one-half broader than long, sides rounded at middle; surface extremely minutely punctured, obscure fulvous with greenish æneous gloss. Scutellum triangular. Elytra subcylindrical and parallel, of a brassy-green colour, very finely punctate-striate; interstices flat and impunctate; the lateral margins deflexed, bounded above by a longitudinal ridge. Legs robust, fulvous. Prosternum narrowly elongate, carinate at the sides, fulvous; rest of under side black, nearly impunctate.

Hab. Tucuman, Argentine Rep. Coll. La Plata Mus. and my own.

From *C. auratus* Fab. and allied species the present one may be known by the fulvous, not æneous or green thorax, this part having only a slight æneous lustre, and by the black under side. In the male the elytral puncturation is scarcely perceptible except under a strong lens.

Cryptocephalus haitiensis, sp. n.

Metallic purplish blue; abdomen and tarsi black; thorax finely punctured; elytra strongly punctate-striate.

Length $2\frac{1}{2}$ millim.

Of broadly subquadrate shape, entirely purplish; the head with a few punctures and some sulci at the vertex, the latter very narrow on account of the rather closely approached eyes, these triangularly emarginate; clypeus well separated from the face, broader than long, sparingly punctured; antennæ purplish, slender, rather short, the terminal three or four joints slightly thickened. Thorax not more than one-half broader than long, convex, sides feebly rounded, but little narrowed anteriorly, posterior angles rather strongly produced; surface somewhat uneven, finely and not very closely punctured, the punctures shallow. Scutellum narrow, longer than broad, black. Elytra scarcely more than double the length of the thorax, rather strongly punctate-striate, with a shallow fovea immediately below the shoulders. Body below dark blue, shining. Prosternum subquadrate, posterior margin feebly rounded.

Hab. Port-au-Prince, Haiti.

Smaller than *C. rufitarsus* Suff. and *C. tristiculus* Weise from Porto Rico, entirely metallic, the elytral punctures straight, the interstices impunctate.

Cryptocephalus argentinus, sp. n.

Bluish black; basal joints of the antennæ, lower portion of face and legs flavous; thorax finely granulate; elytra very finely punctate-striate.

Length $1\frac{1}{2}$ millim.

Head impunctate, black at the vertex, lower portion flavous; eyes but feebly notched; antennæ black, basal joint flavous, third and fourth joints small, equal, terminal joints strongly thickened. Thorax scarcely twice as broad as long, strongly narrowed anteriorly, the anterior margin preceded by a narrow transverse sulcus; surface not perceptibly punctured, median lobe of basal margin truncate; disc black and shining. Scutellum elongate and pointed, longer than broad. Elytra finely punctate-striate, slightly greenish black; the punctures rather widely separated, distinct to apex; last interstice slightly convex, shoulders tuberculiform. Legs fulvous, knees and tarsi piceous. Prosternum subquadrate, posterior margin emarginate.

Hab. Buenos Ayres, Argentine Rep.

A very small species, of subquadrate shape and with antennæ much like a *Monachus*, but with differently shaped prosternum; the entirely flavous lower portion of the face and the similarly coloured legs distinguish well this species, received from the La Plata Museum.

Gribburius bolivianus, sp. n.

Black; thorax finely and closely punctured, with deep depression at sides; elytra finely punctate-striate, a subquadrate patch at base, not extending to suture, and a round apical spot bright red.

Length 3 millim.

♂. Upper portion and sides of head entirely occupied by the eyes which meet at the middle; clypeus finely rugose; antennæ with the lower five joints black above, obscure fulvous below, third shorter than fourth, both very elongate, rest wanting. Thorax nearly twice as broad as long, sides rounded, moderately narrowed anteriorly; surface extremely finely and subremotely punctured, only visible under a strong lens, the base with a deep transverse depression near the posterior angles. Scutellum very broad at base, impunctate, black. Elytra with a shallow transverse depression below the base across the suture, finely and rather regularly punctate-striate, the space near the suture at the basal portion irregularly punctate, black, with a slight purplish gloss; the humeral red patch extending nearly, but not quite, to suture and downwards to about one-third the length of the elytra, the apical spot round or nearly so, impunctate. Body below clothed with fine yellow pubescence, apex of the tibiæ and the tarsi more or less fulvous. Prosternum much longer than broad, strongly punctured.

Hab. Bolivia.

Smaller than any other species of similar coloration and distinguished by the very fine thoracic puncturation. Female unknown.

GRIBURIUS ORNATUS, sp. n.

Yellowish white; thorax with two longitudinal fulvous bands, sparingly punctured; elytra strongly punctate-striate, dark fulvous, each with five elongate, whitish, raised spots (2 . 2 . 1) and similar narrow stripes near lateral margins.

Length $3\frac{1}{2}$ millim.

Head strongly but sparingly punctured, a small piceous spot at vertex and at base of antennæ, punctures likewise piceous, ground-colour pale yellow; emargination of eyes triangular; antennæ very slender, lower five joints pale, rest black, third joint much shorter than fourth. Thorax scarcely twice as broad as long, sides nearly straight, but slightly narrowed anteriorly, median lobe of basal margin broadly rounded; surface sparingly (but strongly and irregularly) punctured at sides, middle impunctate, basal margin accompanied by a row of deep punctures; a broad longitudinal band, irregularly widened into spots at sides, is placed at each side near middle, the latter has likewise a small spot situated at base. Scutellum pale yellow. Elytra subcylindrical, parallel, the fulvous portion separated by raised whitish elongate spots, of which one is placed near suture, one at shoulders, two at middle, transversely, and a round one at apex; the last interstice near margin is nearly entirely whitish, except below middle; all the pale spots are without punctures, the latter are arranged as follows:—two irregular short rows near suture, followed by four closely placed rows, a few punctures below shoulders and two rows near margins complete the sculpturing; none of the rows extend to apex, the first of the longer ones divides the pale discoidal spot near suture. Legs pale fulvous, anterior femora incrassate.

Hab. Paraguay.

Allied to *G. 17-guttatus* Suff., but with extra pale lateral stripes, and differently sculptured.

Gribürius aureovillosus, sp. n.

Obscure purplish or greenish black; labrum and base of femora fulvous; thorax nearly impunctate; elytra finely punctate-striate anteriorly, a transverse band at base and an apical spot flavous; body below densely golden-yellow pubescent.

Length 5 millim.

Head finely punctured anteriorly only; eyes large and oblique, constricting the head at base, inner margin triangularly and but slightly notched; antennæ extending to base of elytra only, five lower joints fulvous, rest dark, basal joint black above. Thorax more than twice as broad as long, sides angulately and strongly narrowed from middle to apex, and to a less extent at base, with distinct reflexed margins; surface with deep oblique sulcus at sides near base, the depressions more strongly, the disc very finely punctured; median lobe of basal margin broad, feebly but distinctly produced. Scutellum much broader than long, closely and finely punctured. Elytra broad, slightly narrowed at apex, irregularly punctured near suture, rest of disc finely punctate-striate, apex smooth; lateral lobes strongly produced; the flavous band at base of regular shape, extending downwards to one-third the length of the elytra; apical spot transverse. Base of femora, apex of tibiæ, and the tarsi flavous. Prosternum broad, widened posteriorly, base obtusely rounded. Entire under side densely clothed with silky golden pubescence.

Hab. Upper Amazons.

Allied to *G. argentatus* Erichs., but without pubescent sides of thorax and with golden pile on the under side.

Griburius hirtifrons, sp. n.

Bluish black; base of femora fulvous; thorax finely and closely punctured; elytra strongly punctate-striate, a subquadrate patch at base, not extending to suture, and the apex flavous; head finely pubescent.

Length $3\frac{1}{2}$ millim.

♂. Head finely punctured at vertex, lower portion furnished with yellow pubescence; eyes very large, nearly meeting at middle, feebly notched; antennæ long and slender, lower three joints fulvous below, rest black, third and fourth equal. Thorax one-half broader than long, sides rounded at middle, narrowed in front; surface very closely and distinctly punctured, purplish; base with a slight depression at each side near scutellum; median lobe broadly but feebly produced. Scutellum broadly subquadrate, finely punctured. Elytra subquadrately oblong, finely punctate-striate, punctures irregular near suture and partly double at base; apex impunctate; a subquadrate, transverse band at base, surrounding the shoulders, but not extending to suture, and a spot at apex of each elytron flavous. Body below densely clothed with silvery pubescence; base of all the femora and apex of the tibiæ fulvous. Prosternum longer than broad, longitudinally depressed.

Hab. Prov. Goyaz, Brazil.

Allied to *G. prætextatus* Suff., but with finely and closely punctured thorax and totally different elytral puncturation, the scutellum glabrous.

GRIBURIUS NIGRITARSIS, sp. n.

Testaceous; antennæ, parts of breast, and middle of abdomen black; head with two, thorax with four black spots, sparingly punctured; scutellum black; elytra finely and closely punctured, suture, a humeral and lateral spot below middle, black; apex of tibiæ and the tarsi black.

Length 6 millim.

Head rather closely punctured near eyes and at anterior portion, middle with a longitudinal groove, emargination of eyes very broad, base of antennæ with a black spot; vertex with a divided sinuate black transverse band; antennæ long, black, third joint shorter than fourth, terminal joints widened. Thorax scarcely twice as broad as long, lateral margins slightly rounded at base, constricted and nearly straight anteriorly; surface finely and sparingly punctured at middle, more closely and strongly so at sides. Scutellum subquadrate, black, shining. Elytra scarcely wider at base than thorax, elongate, basal margin raised; surface irregularly, closely, and finely punctured; apex obsoletely punctured; extreme sutural margins, a round spot on shoulders and a rather smaller one near the lateral margins at middle black. Sides and apex of abdomen testaceous, breast and middle portion of abdomen black; apex of tibiæ and tarsi likewise black; anterior femora strongly thickened; prosternum flavous as well as the legs, the first-named subquadrate, narrowed posteriorly, rather strongly sulcate.

Hab. São Paulo, Brazil.

Somewhat similarly coloured as *G. conspurcatus* Suff., but differently marked, and separated from this species and *G. abstersus* Suff. by the entirely different elytral sculpturing, in which there is scarcely a trace of an arrangement of the punctures in rows.

GRIBURIUS FEMORATUS, sp. n.

Black; labrum, three spots on the head, and lower margins of the femora yellowish white; thorax strongly punctured; elytra deeply punctate-striate, with a large subquadrate humeral red patch.

Length 5 millim.

Head strongly and closely punctured, black, a narrow, short, transverse stripe between the eyes and a small spot at the emargination of the latter yellowish white, labrum of the same colour; antennæ with the lower six joints fulvous, following two black, rest black, basal joint black above, third joint much shorter than fourth. Thorax about one and a half times broader than long, sides subangulately rounded near base, but slightly narrowed in front; surface with a rather deep oblique impression near base at each side, strongly and rather closely punctured, black, some narrow, irregular, short stripes at the extreme lateral margins pale yellow, basal margin not produced at middle. Scutellum broader than long. Elytra about one-half longer than thorax, very strongly punctate-striate, extreme apex nearly smooth; a regular subquadrate dark red spot is placed at the shoulders, extending inwards as far as the third row of punctures and downwards nearly to the middle of the elytra. Under side black, covered with rather long white pubescence; legs black; femora all margined with yellow below.

Hab. Brazil.

I possess only a single apparently female specimen of this species, which may be known from other somewhat similarly marked by the strong puncturation of the head and upper parts and the regular, nearly square-shaped elytral patch, as well as the colour of the femora.

METALLACTUS BOLIVIANUS, sp. n.

Below black; head obscure fulvous, with a central white patch; thorax short, sparingly punctured, yellowish white, with a large subquadrate black patch at each side; elytra finely punctate-striate, pale yellowish, a transverse band at the base, another below the middle, and the sutural and apical margins black.

Length 4 millim.

Head flat, the inner margins of the eyes, the intermediate space, and the clypeus distinctly punctured, the latter and the vertex obscure fulvous, intraocular space yellowish white; eyes well separated, subquadrately emarginate, this space strongly punctured; antennæ with the lower five joints black (the rest wanting), third joint slightly shorter than the fourth. Thorax twice as broad as long, of equal width, not narrowed anteriorly, the sides feebly rounded anteriorly, the base with a short but deep sulcus at each side; surface very remotely punctured at the disc, the sides rather more closely and strongly so; the ground-colour yellowish white, the sides with a large subquadrate black patch, more closely approached to the anterior than the posterior margin, its lower edge oblique. Scutellum broader than long, finely punctured, black, its apex truncate. Elytra parallel-sided, rather strongly punctate-striate, the punctured rows closely approached and rather irregular at the base, more widely separated posteriorly, of the same colour as the thorax, the base with a transverse narrow black band not extending to the lateral margins; a similar band is placed below the middle, extending to the extreme lateral and apical margins, the latter therefore including a round flavous spot at the apex of each elytron. Under side and legs black, sides of the abdominal segments flavous.

Prosternum longer than broad, very broad and slightly concave at the base, gradually narrowed at the apex, the latter rounded.

Hab. Bolivia.

Closely allied to *M. bifasciatus* Jac. (Mitt. ent. Gesells. München, 1878, p. 142), but the thorax with two lateral not one median spot, and finely and sparingly punctured, the head not black.

METALLACTUS FLAVOFRONTALIS, sp. n.

Head, antennæ, legs, and breast black, vertex with a flavous spot; thorax strongly punctured, with two large subtriangular black patches; elytra very closely punctured in irregular rows, black, two spots at the middle, two below the latter, the outer ones of both small, a spot at the apex, and the epipleuræ at the shoulders, yellow; sides of the abdomen and pygidium likewise yellow.

Length 5 millim.

Head very strongly and closely punctured, black, the vertex with a round yellow spot; labrum fulvous; antennæ long and slender, black, the lower four joints flavous below, the third joint one-half longer than the fourth, terminal joints very elongate and slender, very slightly widened. Thorax scarcely twice as broad as long, the sides rather suddenly narrowed anteriorly; posterior margins strongly thickened at the sides, strongly and rather closely punctured; flavous, with two large black patches, narrow at the apex and extending to the anterior margin, rather suddenly widened at the base, leaving the margin of the ground-colour as far as its thickened portion, the space dividing the spots in shape of a narrow flavous middle line, the sides more broadly of that colour and abruptly widened near the anterior angles. Scutellum flavous, subquadrate, the basal portion black. Elytra with strongly produced lateral lobes, subcylindrical, strongly and closely punctured, with but feeble indication of rows, black; each elytron with five bright yellow spots, the one near the suture at the middle the largest and of round shape, the lower ones more transverse and smaller, the outer two small, the first of these joined to the flavous epipleuræ at the base. Breast, middle of the abdomen, and the legs black; prosternum rugose and pubescent, longer than broad, narrowed between the coxæ, the apex rounded; pygidium and the sides of the abdominal segments flavous.

Hab. Jalahy, Prov. Goyaz, Brazil.

Somewhat similarly coloured as *M. kollari* Perty and allied species, but quite different in the pattern of the elytra in connection with the broadly flavous sides of the abdomen, black legs, &c.

METALLACTUS AFFINIS, sp. n.

Flavous, the vertex of the head, the antennæ, and the tibiæ and tarsi black; thorax strongly punctured, with a transverse sinuous black band; scutellum black; elytra strongly punctate-striate, each with six small black spots (2 . 2 . 2).

Length $4\frac{1}{2}$–5 millim.

Head strongly rugosely punctured, strongly narrowed between the eyes, the vertex black; a spot at the base of the antennæ and the edge of the clypeus likewise black, rest of the surface flavous; eyes very large, broadly notched; antennæ black, the lower three joints flavous below, third joint one-half shorter than the fourth. Thorax nearly twice as broad as long, the lateral margins very feebly rounded at the middle; the surface transversely depressed near the anterior margin, strongly but not closely punctured, flavous, with a narrow more or less -$\vee$-shaped black band at the middle, abbreviated at the sides. Scutellum subquadrate, black. Elytra with closely approached rows of strong punctures, the rows often irregular with extra punctures, the interstices more or less costate from the middle downwards and at the sides; each elytron with six black spots, the largest of somewhat subquadrate shape at the base, two others much smaller below the middle and the smallest near the apex. Below, the femora and the pygidium flavous, tibiæ and tarsi black; the sides of the breast anteriorly and the metasternum posteriorly sometimes likewise more or less marked with black; prosternum longer than broad, pubescent. Female with a deep abdominal cavity occupying the middle of the last two segments.

Hab. Lagos, S. Brazil.

In general system of coloration this species agrees exactly with spotted varieties of *M. nigrofasciatus*, *M. albifrons*, and *M. albipes*, Suff., but the coarsely punctured elytra, semiconvex interstices, and the extension of the punctures to the apex does not allow the identification of the species with any of those named above, the more so as there are two exactly similar specimens before me.

METALLACTUS ARGENTINENSIS, sp. n.

Black; a spot on the head and the thorax fulvous or flavous, the latter finely punctured, with two black stripes; elytra minutely and closely punctured and finely transversely wrinkled, black, a humeral spot of subquadrate shape and a round spot at the apex flavous.

Length $4\frac{1}{2}$ millim.

Head black, nearly impunctate, the vertex almost entirely flavous, in shape of a large rounded patch, lower portion of face rugose and closely pubescent; labrum flavous; eyes large, widely separated, broadly notched; antennæ slender, black, the lower five joints flavous, the basal joint black above, third joint slightly shorter than the fourth. Thorax about one-half broader than long, subcylindrical, the sides rounded; the surface rather closely punctured at the sides, nearly impunctate at the middle, flavous, with two longitudinal black bands from the base to the apex, these meet in front and are suddenly narrowed from the middle downwards, forming acute angles at each side at their widest portion. Scutellum broadly subquadrate, punctured and pubescent at the base. Elytra broadly subquadrate, punctured in closely approached irregular rows, the interstices finely wrinkled, black; the shoulders with a large subquadrate flavous patch, the apex with a round smaller spot. Below and the legs black; the anterior femora thickened, longer than the others, their tibiæ curved.

Hab. Cordoba, Argentine Republic.

METALLACTUS CAPITATUS, sp. n.

Head and anterior femora purplish blue; scutellum black; thorax and elytra dark fulvous, the latter strongly punctate-striate; body below bluish, closely silvery pubescent; tibiæ and tarsi fulvous.

Length 6 millim.

Rather large and robust; head with a longitudinal central groove, the lower portion distinctly punctured; labrum black; eyes rather closely approached (♀), triangularly notched at lower portion; antennæ slender, bluish, lower five joints fulvous, third and following two joints very elongate. Thorax more than twice as broad as long, sides strongly subangulately rounded at middle, constricted in front and at base; disc with a rather broad transverse depression near the posterior angles, the middle finely and remotely, the sides more strongly punctured. Scutellum finely punctured, scarcely longer than broad, black. Elytra scarcely wider at base than the thorax, the humeral lobes strongly produced; surface with very deep and irregular rows of punctures, these much finer and more regular below the middle; interstices at base somewhat convex. Body below strongly inflated; legs elongate; anterior femora thickened, entirely, intermediate femora partly, blue; prosternum subquadrate, slightly carinate at middle.

Hab. Espiritu Santo, Brazil.

Quite distinct in coloration than any of the described species, the head purplish, the elytral puncturation deep and strong, the entire upper surface unicolorous.

METALLACTUS SEMIPURPUREUS, sp. n.

Obscure purplish; thorax very finely punctured; elytra strongly punctate-striate, the humeral lobes and a round spot at apex of each elytron pale fulvous.

Length 5 millim.

Head with a few punctures near the eyes, the latter rather closely approached, large, with a small notch at lower portion; anterior part of head rugosely punctured; antennæ slender, black, lower six joints fulvous, basal joint black above. Thorax twice as broad as long, sides rounded near base, gradually narrowed anteriorly; surface very finely and remotely punctured at disc; sides more closely punctured, with a rather deep transverse depression near base; median lobe but very slightly produced. Scutellum subquadrate, apex broadly truncate, surface longitudinally strigate and finely pubescent. Elytra with deep and irregular rows of punctures, those near the suture still more confusedly placed; all rows distinct except at the extreme apex, the latter with a round fulvous spot not extending to either margin; another narrow elongate spot is placed in front of the shoulders, extending nearly to the middle of the lateral margins but not to the humeral callus. Body below finely pubescent, black; legs purplish black, extreme base of the femora fulvous. Prosternum broad, subquadrate, finely punctured and pubescent, surface slightly concave.

Hab. Brazil.

The entirely purplish ground-colour, strong elytral punctuation, and the shape of the elytral markings distinguish this species, of which I received a specimen from Mr. C. Bruch, of the La Plata Museum, without detailed locality. *M. palæmon* Suff. and allied species all differ in their black colour and different markings.

Metallactus peruanus, sp. n.

Flavous; vertex with a black spot; thorax and elytra black, the last-named with four raised spots placed subquadrately at suture, two other spots at apex and the pygidium white.

Length 4 millim.

Head with a few punctures at vertex, the latter with a triangular black spot at base, middle with a longitudinal groove, entire sides occupied by the large oblique eyes, which closely approach at top, their emargination very broad and subtriangular, their surface spotted with black; lower portion of face impunctate; base of antennæ with a brownish spot, lower six joints piceous, more or less pale at base, rest broken off, third joint shorter than fourth. Thorax about one-half broader than long, narrowed anteriorly, the sides and middle with patches of irregularly placed distinct punctures, forming a W-shaped band, rest of surface impunctate, black. Scutellum obscure fulvous, truncate at apex. Elytra with fine, partly geminate rows of punctures at the black portions only, the white spots impunctate, raised, those near the scutellum raised to a point at the apex of the latter; the black portion at the sides likewise convex and smooth, surrounded by a few rows of punctures; each elytron with three large round white patches, one at base near the scutellum, followed immediately by a similar patch at the suture, and the third rather smaller at the apical angle; besides these markings, a short elongate spot somewhat obscure is placed near the lateral margins at the apex. Pygidium, under side, and legs yellowish white; prosternum twice as long as broad.

Hab. Peru.

This is one of the most peculiarly marked and sculptured species of the genus, and much distinguished by the raised black and white elytral spaces devoid of punctures and the elytral markings. I have only a single specimen.

METALLACTUS DIVISUS, sp. n.

Below black; thorax dark purplish, closely punctured; elytra strongly and closely punctate-striate, flavous, a sutural, posteriorly widened band and a broad, elongate, subquadrate patch at the sides purplish; femora fulvous.

Length 3 millim.

♂. Upper portion of head entirely occupied by the large eyes, which meet at the top, they likewise extend sideways down to the clypeus and are triangularly but not deeply emarginate at the base of the antennæ; clypeus triangular, deeply punctured, purplish; antennæ slender, black, lower four joints fulvous below, third and following joints very elongate. Thorax about one-half broader than long, sides widened at middle; surface rather strongly and closely punctured, with a deep oblique depression at each side near the base, the puncturation at the sides scarcely stronger than at middle. Scutellum longer than broad, finely punctured, greenish black. Elytra wider at base than the thorax, parallel-sided, with a shallow transverse depression below base; shoulders very prominent; surface closely and strongly punctate-striate, the punctures near the suture irregularly placed, interstices at the sides slightly costate; the suture with a purplish band, very narrow at base, but suddenly angulately widened near the apex; the sides with an elongate subquadrate band, which commences before the middle and ends obliquely before the apex, this band approaches very closely the sutural stripe at its middle, but is rather abruptly constricted behind, leaving the apex in shape of a rounded spot of the flavous ground-colour. Legs flavous, the anterior tibiæ and tarsi darkened. Prosternum longer than broad, strongly rugose-punctate.

Hab. Gov. Chaco, Argentine Rep.

More closely allied to *M. succinctus* Suff. than to any other species, but the eyes touching, only feebly emarginate, clypeus coarsely punctured, pattern of elytra different, and general size much smaller.

METALLACTUS UNICOLOR, sp. n.

Entirely fulvous, apical joints of antennæ black.

Length 4 millim.

Head impunctate at the vertex, lower portion depressed, with a few fine punctures widely separated; emargination of the eyes narrowly subquadrate, finely punctured; antennæ black, basal joint fulvous, third and fourth joints elongate, equal, terminal four wanting. Thorax twice as broad as long, obliquely but moderately constricted anteriorly; lateral margins feebly rounded below the middle, anterior margin preceded by a short depression at middle, base with a deep transverse short sulcus near the anterior angles; surface very remotely and irregularly punctured. Scutellum strongly raised, broad, impunctate. Elytra not wider at base than the thorax, finely and irregularly punctured at basal portion, partly geminate; puncturation from middle downwards more regular and in single rows, last two rows more distinct; interstices flat. Prosternum longer than broad, deeply concave anteriorly.

Hab. Brazil.

Of entirely fulvous colour; the puncturation of thorax very remote, that of the elytra irregular at base. I received a specimen from Mr. C. Bruch at the La Plata Museum without a more detailed locality.

Metallactus donckieri, sp. n.

Yellowish white; thorax sparingly punctured, disc with a black triangular spot; elytra closely punctate-striate, a transverse band at the base and another at the apex black.

Var. Elytra with two spots at base and one below middle black.

Length $3\frac{1}{2}$ millim.

Head with central longitudinal groove, nearly impunctate at vertex, the latter sometimes with a triangular black spot; lower portion of the clypeus and the labrum brownish; lower four joints of antennæ more or less pale below, following three black, rest wanting, third and fourth joints equal. Thorax twice as broad as long or somewhat broader, sides nearly straight, base with a deep oblique depression at each side; surface sparingly impressed with deep punctures at disc and sides, the middle with a triangular black spot or fulvous band, sides with another more obscure mark. Elytra with closely placed rows of deep punctures of transverse shape, those near the suture more confusedly arranged, the punctures partly absent at the middle between the 6th and 8th rows; interstices slightly convex. Pygidium, under side, and legs yellowish white; prosternum slightly longer than broad.

Hab. Jalahy, Prov. Goyaz, Brazil.

I have taken the banded form as that of the type, but between this and the spotted varieties probably other variations occur. The species seems almost identical with some of the varieties of *M. nigro-ornatus* Stål, but may be at once distinguished by the pale under side and legs, and by the interrupted punctures at the sides of the elytra.

Metallactus partitus, sp. n.

Head, breast, and middle of the abdomen black; clypeus flavous; thorax fulvous, with an anterior black spot, closely punctured; elytra finely punctate-striate, black, a transverse band at the middle fulvous.

Length $3\frac{1}{2}$ millim.

Head sparingly punctured at vertex, the latter black, lower portion pale fulvous, strongly punctured; anterior edge of clypeus black, labrum pale fulvous; eyes closely approached at middle, very large, their emargination small and triangular; antennæ extending to middle of elytra, black, lower five joints fulvous, third joint slightly shorter than fourth, basal joint black above. Thorax about one-half broader than long, sides obliquely but moderately narrowed anteriorly; surface closely and strongly punctured at the sides, more finely and remotely so at the disc; a triangular black spot is placed at the middle of the anterior margin, extending downwards beyond the middle of the disc. Scutellum subquadrate, black, its apex broadly truncate. Elytra scarcely or not wider at base than thorax, closely and finely punctured in irregular rows anteriorly, the latter more distinct and widely separated below the middle, black, with a transverse, slightly curved, fulvous band placed immediately before the middle. Pygidium and sides of the abdomen pale yellow; anterior legs black, their femora strongly incrassate, upper portion flavous; posterior femora flavous with a black spot near the base; tibiæ and tarsi black; breast and the first three abdominal segments likewise black. Prosternum subquadrate, its posterior margin triangularly produced. Female unknown.

Hab. South Brazil.

Allied to *M. semirufus* Suff., but the thorax with a black patch, the apical portion of the elytra likewise black.

METALLACTUS INUSTUS Suffr. Linn. Ent. xvi. p. 252.

Suffrian has described specimens in which the pubescence of the upper surface was partly rubbed off; in the perfect insect, not only the thorax but also the elytra are closely covered with white hairs, which on the last-named parts are somewhat arranged in rows. Varieties of this species occur which have entirely black elytra. The insect is of dull appearance when perfect, but very shining if the hairs are wanting.

METALLACTUS NIGROVITTIS, sp. n.

Below black; head flavous; thorax closely punctured, black, anterior and lateral margins and two spots at base flavous; elytra strongly punctate-striate, interstices costate, the sides and a broader sutural band black; legs fulvous.

Length 2 millim.

Head at sides entirely occupied by the large eyes, which meet at the vertex, lower portion and labrum flavous, strongly and closely punctured; antennæ pale fulvous, third joint not longer than second, much shorter than fourth. Thorax one-half broader than long, not narrowed anteriorly, sides rounded; surface very closely and strongly, almost rugosely punctured, black; anterior margin very narrowly, sides more broadly flavous, the base with two oblique flavous spots of elongate shape. Scutellum black, subquadrate. Elytra with deep transverse punctures placed in close rows, the space near the suture irregularly punctured; the interstices longitudinally costate and thickened; the sutural band constricted posteriorly and then suddenly widened, not extending to apex; the lateral bands equally broad but of more regular shape, occupying the last three rows of punctures. Below black, finely pubescent; legs fulvous. Prosternum longer than broad, its base truncate.

Hab. Chaco, Argentine Rep.

3. Environmental Studies on the Limpet.

By E. S. RUSSELL, M.A.*

[Received May 30, 1907.]

(Text-figures 217–228.)

Introduction.

The object of this paper is to correlate certain modifications of the shell of *Patella vulgata* with definite environmental conditions. *Patella* is stationary; hence if one takes a number of shells from one locality and contrasts them with a number from another locality, which differs from the first in certain definite respects, any differences between the two sets may be safely put down to the influence of the environmental factors in which the localities differ. That is true if there has been no selective process at work, and since the differences found were slight and apparently of no selective value I have assumed the absence of selection. Measurements were made of several hundred shells from definite localities and the ratios of the dimensions calculated. Since the ratios of length to breadth $\left(\frac{L}{B}\right)$, length to height $\left(\frac{L}{H}\right)$, and distance from apex to posterior edge to distance from apex to anterior edge $\left(\frac{Ab}{Af}\right)$ change very rapidly with the growth of the shell, it has been necessary to arrange the ratios in groups according to the size of shell, and to calculate the mean values for each group separately.

The shells measured were collected in 1903 and 1904 at W. Bennan, Arran. A few shells of *P. athletica* were included.

I desire to express my indebtedness to Dr. J. F. Gemmill, Glasgow University, whose interesting papers on sex in the Limpet are well known, for much helpful criticism.

I hope to work out from my data on a future occasion some results concerning variation, laws of growth, and correlation in the shell of *Patella.*

I. *The Homing Habit of the Limpet.*

It has long been matter of common knowledge that a limpet, when once it has taken up a fixed position on a rock, only leaves that position to make short excursions for food, and returns always to it. This fact may be taken as well established.

Most of the published observations, however, concerning this habit of the limpet record merely isolated cases. and many gaps remain in our knowledge of it.

There is no agreement among authors as to the time at which the limpet leaves its "home" to seek for food. Lukis (**10**), Jeffreys (**9**), Peach (quoted by Jeffreys), and Robertson (**14**) state that the limpet wanders when covered by the tide. Davis (**3**) and H. Fischer (**6**) state that it wanders while uncovered, and

* Communicated by the SECRETARY.

P. Fischer (**7**) says that young ones wander only when uncovered. Bouchard-Chantereaux (**1**) says that it makes its excursions just after the tide goes out, Lloyd Morgan (**11**) that it wanders chiefly as the tide leaves it, and as the tide returns. Lloyd Morgan and Roberts (**13**) are of opinion that it does not move about when submerged.

The observations recorded in this paper show that limpets above 20 mm. or so in length do not wander when uncovered by the tide. Smaller limpets, however, may wander even when uncovered, but also when they are covered by the tide. I believe that the differences of opinion regarding this point arise from the fact that the habit of fixity becomes established only when the shell has reached a length of 10–15 mm. Dr. Robertson's observations seem to me to be the fullest and most satisfactory of all. He found that limpets go out on the flow of the tide, sometimes for two consecutive tides, sometimes alternately. Limpets in captivity had very much the same habits, going out to browse about once in the twelve hours.

The greatest distance from which a limpet has been known to return to its "home" is three feet (Davis, 3).

The seat of the limpet's marvellous sense of direction is quite unknown, and the accuracy with which it returns to a definite spot is very astonishing. Several observers (Lukis, Roberts, Hawkshaw, Robertson, Morgan) have noticed that the edge of the shell is often accurately adjusted to the irregularities of the rock, or to barnacles, round about the "home." I have recorded in this paper one or two other instances of the same thing.

As to how long a limpet may stay in one spot, Lukis records the fact that five limpets observed in 1829 were found in the same position several months after; and I have had one or two under observation for six months which kept exactly to the same spot.

I give here some observations made in 1906 at Kames, Kyles of Bute, on a number of limpets in their natural habitat. Each of the limpets had a distinctive mark filed on its shell, so that no mistake as to identity might be made. All the measurements were taken while the limpets were uncovered by the tide. The first table refers to four limpets, ranging in size from 34 mm. to 44 mm., which grew close together on a ledge of rock near high-water mark.

Table I.

Distances apart (in mm.).	30th June.	3rd July.	10th July.	26th July.	30th July.
1 and 2	42	41	42	41	41
2 and 3	65	65	65	64·5	64·5
3 and 4	35	34	35	36	35
4 and 1	75	76	74·5	75	75·5

During a whole month, therefore, the relative positions of these limpets remained practically unchanged. One of them, No. 3, was almost surrounded by barnacles, to which its shell fitted accurately.

The relative positions of another series of limpets for various dates during a month are given in Table II. The sizes ranged from 8·5 mm. to 34 mm. The stone on which they were lay near low-water mark, and was largely overgrown with *Fucus*.

TABLE II.

Distances apart (in mm.).	30th June.	7th July.	10th July.	26th July.	30th July.
1 and 2	29	...	30	80	65
1 and 3	44	...	44	42·5	44·5
3 and 4	87	...	87·5	92	88
4 and 5	49	65	(46), 49	46·5	46
5 and 6	98	...	(90), 98	97·5	102
7 and 8	4th July. 9	50	19	...	300

At first sight these data seem contradictory of those in Table I., but the inconsistencies can be easily explained. The limpets in Table I. are all large; in Table II. only Nos. 1, 3, and 4 are more than 30 mm. long. The relative positions of Nos. 1, 3, and 4 are very constant. No. 2 in Table II. is a limpet 8·5 mm. in length, and the great variation of its distance from No. 1 (30·5 mm. long) covers the fact that No. 2 wandered, while No. 1 was quite stationary. Nos. 7 and 8 are small limpets—both under 15 mm.—and both wandered a good deal. Nos. 5 and 6 are limpets 20 mm. and 24 mm. long respectively, and their relative distance (and also No. 5's distance from No. 4) shows on the whole quite small variations. The greatest variation of No. 5's distance from No. 4 is that given under date 7th July, when the distance was 65 mm. as against the usual 49 mm. On this occasion it was No. 5 which had moved, while No. 4 had not changed its position.

The conclusion may be drawn therefore that large limpets are more fixed in their position than small limpets. It will be noticed that double measurements are given for the distances of Nos. 4 and 5, and 5 and 6, under the date 10th July, and further, that the second measurement in each case is the same as that made on the 30th June. The explanation is rather interesting. On 10th July the first measurements (those in brackets) had just been made when I noticed that No. 5 was moving. Nos. 4 and 6 made no movement. No. 5 crept a few millimetres, and fitted the indentations of the hinder edge of its shell to three barnacles adhering to the stone. It then settled down as if for good, and moved no more. On re-measuring its distances from No. 4 and No. 6, I found them to be identical with the distances measured on 30th June. Evidently the positions of No. 4 and 6 were definitely fixed, and No. 5, too, had a definitely fixed place of abode and was able to find its way back thereto with astonishing accuracy.

On the 26th and 30th July I noticed that the weed growing on the stone had covered over most of the limpets and so kept them moist. I believe that under these circumstances the limpets, especially the small ones, moved about a little more than usual, and did not return so carefully to their fixed positions. The figures certainly show considerable variations for these dates.

I kept records also of the movements of five small limpets, *a* (10 mm.), *b* (13 mm.), *c* (4 mm.), *d* (7 mm.), and *e* (5·5 mm.). They were under observation at intervals for over three weeks. The records may be summarised as follows:—*a* was to be found always within a few centimetres of one fixed spot, and on the 11th, 12th, and 30th July was found on that spot, with its shell fitted to a *Spirorbis*-tube and to a barnacle. On the 30th July I saw it move to the spot and adjust itself. Limpet *b* was more irregular, and did not seem to have a fixed stance, but it was always to be found near at hand. Limpet *c* changed its position by a few centimetres from time to time. Limpets *d* and *e* occupied on 5th July a definite position on a clearly marked circular space on a stone. On the 10th, 11th, 26th, and 30th of the same month they occupied exactly the same positions. On the 7th they were distant 4 cm. and 8 cm., evidently in search of food. On the 12th, at 9.30 A.M., *e* was in position, *d* 3 cm. away. The stone had just been uncovered, and *d* was on its way "home." Twenty minutes later I found *d* in position. These two limpets therefore had a definite home, to which they returned when the tide left them high and dry.

A well-known fact which goes far to prove the homing habit of *Patella* may here be mentioned. One may often find on the shore a limpet quite surrounded and hemmed in with barnacles. If one knocks the limpet off one finds a clear space on the rock below, the outline of which, formed by the barnacles, closely follows that of the limpet's shell. Another fact of the same kind may often be observed. If a large limpet adhering to a smooth surface of rock be detached, a dark "weathering," of shape corresponding to the limpet's, will usually be seen.

The former of these facts affords a simple method of determining the size at which a limpet settles down to a fixed abode. I have not seen any below 10 mm. in length occupying a definite position marked out by barnacles. Near low-water mark the average size at which limpets settle down seems to be, as determined by this method, about 15 mm., though I have seen several fixed from 10–12 mm. long. Davis (**4**) found a limpet $\frac{17}{30}$ inch long homing, and also smaller ones.

From all these observations, then, the following conclusions can be drawn:—(1) that every limpet of 15 mm. and upwards occupies, for long periods at a time, a definitely fixed position, to which it returns after any wanderings that it may make for food; (2) that limpets under 15 mm., if not yet settled in a definite position, at least never wander far away, and so generally keep to the same stone; (3) that limpets wander chiefly when covered by the tide.

In many cases, of course, the limpet settles down at a much smaller size than 15 mm.—for example, *a* at 10 mm., *d* at 7 mm., and *e* at 5·5 mm. The factors delaying fixation would seem to be three: 1st, a short exposure to air; 2nd, the moisture and shelter afforded by weed; 3rd, want of a suitable place for settling down. The late fixation of low-water limpets is undoubtedly due to the first two causes, which usually act in conjunction with one another. The third factor comes into play in the case where a small limpet establishes itself on a stone which is completely covered with barnacles, and can find no uncovered patch of rock on which to settle down.

II. *High-water and Low-water Limpets.*

Table III. gives the average ratios for 300 limpets collected at two different stations near high-water mark, 200 at Station 1, and 100 at Station 2.

TABLE III.

High-water Limpets.

Size.	No. measured.	$\frac{L}{B}$.	$\frac{Ab}{Af}$.	$\frac{L}{H}$.	$\frac{H}{B}$.
5—10 mm.	6	1·25	1·58	3·86	·324
10—15 ,,	30	1·28	1·52	3·67	·349
15—20 ,,	64	1·24	1·42	3·44	·360
20—25 ,,	21	1·25	1·45	3·19	·392
25—30 ,,	13	1·22	1·34	2·95	·414
30—35 ,,	11	1·21	1·39	2·73	·443
35—40 ,,	16	1·18	1·28	2·53	·466
40—45 ,,	29	1·16	1·29	2·30	·504
45—50 ,,	55	1·15	1·26	2·18	·528
50—55 ,,	47	1·15	1·22	2·04	·564
55—60 ,,	7	1·15	1·19	2·05	·561
60—65 ,,	1	1·15	1·27	2·21	·520

Table IV. gives the average ratios of a like number of shells collected—200 at Station 1, 100 at Station 2—at low water.

TABLE IV.

Low-water Limpets.

Size.	No.	$\frac{L}{B}$.	$\frac{Ab}{Af}$.	$\frac{L}{H}$.	$\frac{H}{B}$.
0— 5 mm.	1	1·33	1·50	3·33	·399
5—10 „	15	1·34	1·67	3·45	·388
10—15 „	51	1·29	1·60	3·85	·335
15—20 „	53	1·28	1·51	3·61	·355
20—25 „	36	1·25	1·44	3·67	·341
25—30 „	29	1·23	1·37	3·31	·372
30—35 „	29	1·21	1·34	3·11	·389
35—40 „	20	1·19	1·33	3·05	·390
40—45 „	27	1·17	1·26	2·86	·409
45—50 „	18	1·17	1·24	2·77	·422
50—55 „	11	1·16	1·16	2·59	·448
55—60 „	7	1·15	1·19	2·67	·431
60—65 „	2	1·18	1·11	2·36	·500
65—70 „	1	1·18	1·48	2·75	·429

In considering the differences between the two sets of shells only those between 10 mm. and 55 mm. in length will be taken into account, since those below 10 mm. and above 55 mm. are too few to give smooth results.

$\frac{L}{B}$.—This ratio is greater in low-water than in high-water shells for every stage except two, viz. 20–25 mm. and 30–35 mm., where it is the same in both. High-water shells are therefore at almost every stage a little broader than low-water shells.

$\frac{Ab}{Af}$.—This ratio is on the whole greater in low-water shells up to about 40 mm., when it becomes smaller in the low-water than in the high-water shells. The apex would seem therefore to be further forward in low-water shells up to 40 mm. in length and thereafter further back than in high-water shells.

$\frac{L}{H}$.—The high-water limpets are at all stages higher spired than the low-water limpets.

$\frac{H}{B}$.—The high-water shells are at all stages narrower in proportion to their height.

As to the causes of these differences, one can say little more than that they must be due to those factors in which a high-water environment differs from a low-water environment.

Size of High-water Limpets.—It seems to be the opinion of most authorities that high-water limpets are on the whole smaller than low-water limpets.

Canon Norman (**12**) says definitely:—"It will be found to be a general rule with regard to the Limpet, that the nearer high-water mark the shells are taken, the higher spired, more strongly ribbed, and smaller it will be; and that the lower down it lives, the flatter, less ribbed, and larger it becomes." While my observations entirely corroborate the truth of the statement that high-water limpets are typically high-spired, yet I find, for one area at least, that the proportion of large shells is greater at high-water than at low-water. Table III. shows that of 300 high-water limpets collected without conscious preference of large over small, 161, or $53\frac{2}{3}$ per cent., were under 40 mm. in length, and 139, or $46\frac{1}{3}$ per cent., were over 40 mm. From Table IV. it appears that 234, or 78 per cent., of the low-water shells were below 40 mm., and only 66 or 22 per cent. were above 40 mm. in length. The average maximal size of the high-water shells is about 55 mm., of the low-water shells about 50 mm. For the locality therefore in which these limpets were collected, the proportion of large limpets was considerably greater at high-water than at low-water.

Of course that does not mean that here and there a low-water limpet may not be found as large as, or larger than, any high-water limpet. As a matter of fact, of the six specimens over 60 mm. long which I obtained among the 1000 collected, three came from high-water, and three from low-water level; and the largest of these, a limpet 66 mm. long, came from low-water level.

III. *Sheltered and Exposed Limpets.*

Table V. gives the mean ratios of 100 limpets collected from sheltered situations in one definite locality, and of 100 limpets collected from exposed situations in the same locality.

TABLE V.

	Sheltered.			Exposed.		
Size.	$\frac{L}{B}$.	$\frac{Ab}{Af}$.	$\frac{L}{H}$.	$\frac{L}{B}$.	$\frac{Ab}{Af}$.	$\frac{L}{H}$.
10—15 mm.	1·29	1·46	3·38	1·32	1·49	2·75
15—20 ,,	1·25	1·41	3·08	1·31	1·49	3·12
20—25 ,,	1·23	1·44	3·13	1·28	1·34	2·83
25—30 ,,	1·23	1·39	2·84	1·23	1·41	3·02
30—35 ,,	1·16	1·35	2·62	1·23	1·30	2·49
35—40 ,,	1·16	1·34	2·37	1·21	1·34	2·50
40—45 ,,	1·15	1·29	2·22	1·18	1·23	2·28
45—50 ,,	1·16	1·23	2·07	1·16	1·18	2·25
50—55 ,,	1·15	1·25	2·07	1·15	1·18	2·19
55—60 ,,	1·16	1·16	2·00	1·15	1·13	2·29

Table VI. gives ratios for a series of 100 exposed shells from another locality.

TABLE VI.

Exposed Limpets.

Size.	$\frac{L}{B}$.	$\frac{Ab}{Af}$.	$\frac{L}{H}$.
10—15 mm.	1·27	1·59	3·26
15—20 „	1·33	1·47	3·33
20—25 „	1·25	1·47	3·00
25—30 „	1·26	1·38	2·75
30—35 „	1 22	1·28	2·72
35—40 „	1·21	1·35	2·49
40—45 „	1·21	1·29	2·48
45—50 „	1·17	1·27	2·37
50—55 „	1·17	1·28	2·25
55—60 „	1·15	1·22	2·18

The numbers measured are rather small to give very definite results; and the distinction between sheltered and exposed limpets is a little arbitrary. Shells which were attached to the under side of stones, or to the side nearest the shore, or which lurked in nooks and crevices, were taken to be sheltered; while shells attached to the upper side, or to the side nearest the sea, were considered to be exposed.

$\frac{L}{B}$.—The exposed shells are on the whole narrower than the sheltered shells.

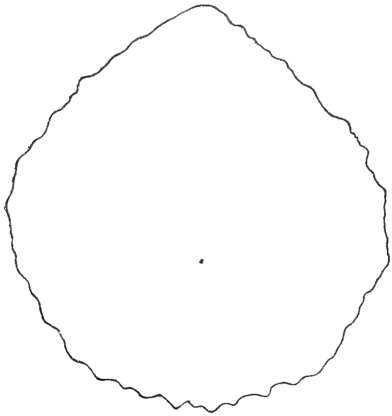
$\frac{Ab}{Af}$.—No definite conclusion can be drawn from the differences shown by this series.

$\frac{L}{H}$.—Comparison of the ratios for shells below 30 mm. gives conflicting results. For shells above 30 mm., however, this ratio is distinctly greater in both sets of exposed shells than in the sheltered set. Exposed shells of 30 mm. and upward are therefore lower than sheltered shells of corresponding length.

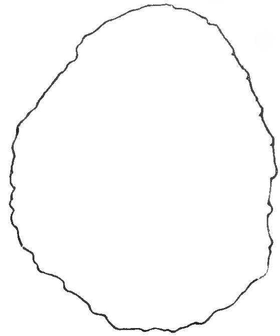
The fact that the decrease in height becomes apparent only in large shells leads one to think that the decrease is due to the greater erosion to which exposed shells are necessarily subject. The differences between the two sets of shells must be explained as the direct result of the difference in the amount of friction to which they are respectively subjected.

These observations partly bear out and partly contradict the statement made by Davis and Fleure (**5**) that the shells of limpets

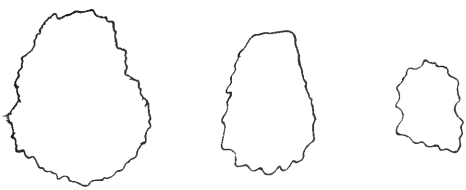
Text-fig. 217.



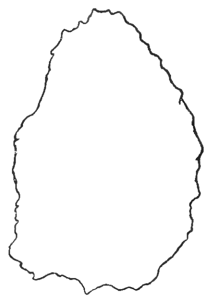
Text-fig. 218.



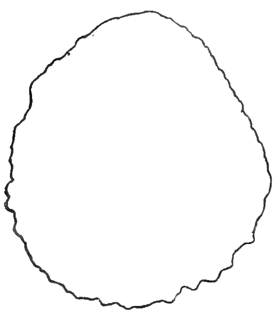
Text-fig. 219.



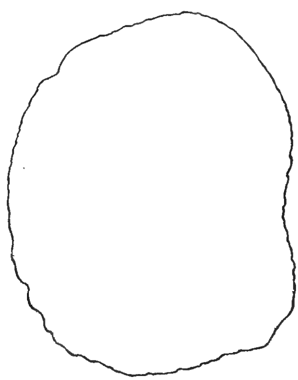
Text-fig. 220.



Text-fig. 221.



Text-fig. 222.



Text-figs. 217–222.—Some irregular outlines, all of exposed shells.

on exposed flat surfaces are typically low and broad, and that shells on sheltered surfaces are typically high and narrow.

The results obtained by Cooke (**2**) for shells of *Purpura lapillus* may be recalled here. He found that shells in exposed places were stunted and had a large mouth, and that shells in sheltered spots were large and possessed a well-developed spire and a small mouth. With regard to stunting, I find that a larger proportion, namely 55 per cent., of the exposed shells are below 40 mm. in length, than in the case of the sheltered shells, where the proportion is 34 per cent. This fact may point to some stunting among the exposed shells, but many exposed shells reach a great size.

Two other points of difference between exposed and sheltered limpets, and perhaps more important ones, become evident when a number of exposed shells are directly compared with a number of sheltered shells. Exposed shells are typically thick and heavy. This thickness of the shell is probably a direct adaptation to the greater shocks which an exposed shell has to withstand. The second difference is that exposed shells are much more irregular in outline than sheltered shells. Of the shells which I kept on account of their irregular outline, the majority came from exposed limpets, and the outlines selected for illustration (text-figs. 217–222) are all drawn from exposed shells. On the other hand, the most beautiful symmetrical shells to be got are those which one finds on the smooth under surface of a stone in a rock-pool, *i. e.* in a very sheltered situation. It is natural that exposed limpets should fit their shells to the irregularities of the rock to which they cling, in order to gain support against the waves and tide, and that (as will be shown in the next section) their shells should for this reason grow irregular in outline.

To sum up, adult exposed shells of *Patella* are lower spired, narrower, thicker, and more irregular in outline than sheltered shells; and these differences are probably due to the difference of friction to which the two kinds of shells are exposed from waves and tide.

IV. *Limpets on Rough Stones and Limpets on Smooth Stones.*

While I was collecting limpets for measurement at the Southend of Arran I noticed that they were of two distinct types, a "rough" type and a "smooth" type. The former was the typical *P. vulgata* L., the latter the variety *cærulea* L. (Jeffreys, **9**). It became evident after a little careful observation that the rough type occurred always on rough stones, the smooth type always on polished stones.

I examined some 500 limpets with regard to their habitat, and I found few exceptions to this rule.

The detailed records are given in Tables VII., VIII., and IX.

TABLE VII.

Limpets on Rough Stones.

Stone.	No. of Limpets.	Rough type.	Intermediate type.	Smooth type.
No. 1	45	44	...	1
" 2	50	42	8	.
" 3	55	45	10	.
" 4	30	30		...
" 5	30	30	...	...
" 6	36	35	...	1
" 7	17	17	...	...
" 8	14	11	...	3 (rock polished)
Totals......	277	254	18	5

TABLE VIII.

Limpets on Smooth Stones.

No. of Stones.	No. of Limpets.	Rough type.	Composite type.	Smooth type.
c. 35	154	1	7	141 + 5 slightly rough

TABLE IX.

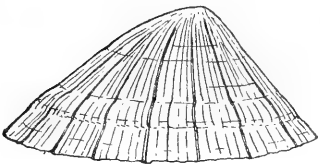
Limpets on Stones partly rough and partly smooth.

Stone.	No. of Limpets.	Rough type.	Intermediate type.	Smooth type.
No. 1	13	5	5	3
" 2	21	12	...	9
" 3	16	7	...	9
" 4	9	3	...	6
" 5	2	...	1	1
" 6	2	1	...	1
" 7	4	1	2	1
" 8	3	2	...	1
Totals	70	31	8	31

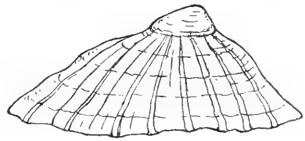
The column headed "Composite type" in Table VIII. requires explanation. Certain shells I came across seemed to be rough above and smooth below, showing that they had been rough during the first few months of their life, and had then become smooth. These I called for convenience "composite."

The locality where these data were obtained happened to be very favourable for the study of the two types of shell. The shore was covered with boulders, some of rough knobby granite, others of smooth polished greenstone. The rough type of limpet occurred on the granite, and harmonised in colour with the greys and browns of the weathered rock. The smooth type occurred on the dark greenstone, and was usually dark in colour. It should

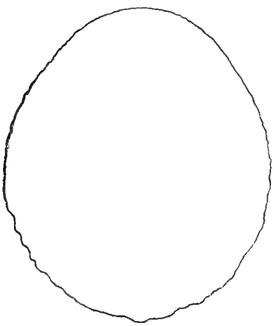
Text-fig. 223.



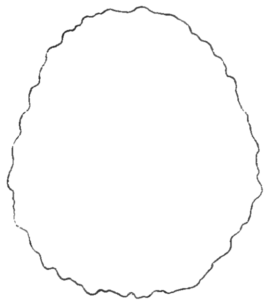
Text-fig. 224.



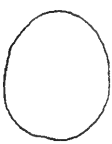
Text-fig. 225



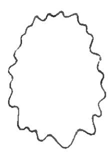
Text-fig. 226.



Text-fig. 227.



Text-fig. 228.



Text-fig. 223.—A typical "smooth" shell.
Text-fig. 225.—Outline of margin of same.
Text-fig. 227.—Marginal outline of a small "smooth" shell.

Text-fig. 224.—A typical "rough" shell.
Text-fig. 226.—Outline of margin of same.
Text-fig. 228.—Marginal outline of a small "rough" shell.

be remarked that the smooth type occurs only on very smooth stones, and that for this reason it is not in every locality that limpets are distinctly separable into rough and smooth types. In places where no polished stones are to be found, there are usually no smooth limpets, but only various shades of rough.

The difference between rough shells and smooth shells must be directly due to the difference of the rock surfaces on which they occur, for this is the sole difference between their respective environments. Smooth limpets and rough limpets (on different stones, of course) may be found within an inch or two of one another, and so subjected to environmental influences identical except in one respect. Moreover, since limpets do not wander from stone to stone (Section I.), the difference in environment between rough and smooth shells is constant during their lives. The differences between the two types of shell are therefore caused by the difference in a single environmental factor.

The question arises, in what way does the surface of the rock modify the growth of the shell so as to give rise to two distinct types of shell, according as the surface is rough or smooth? It is necessary first to state in what particulars the two shells differ.

Differences between the two types.—As stated above, the smooth type corresponds more or less to the variety *cærulea* L. (the *P. cærulea* of Linné, S. N. p. 1259), which is thus defined by Jeffreys: "Shell depressed, roundish oval, ribs more delicate and less regular, inside dark blue." It is found "on flat stones and slabs of rock at low water."

The chief peculiarities of the smooth shell are its regular outline, and the number and minuteness of its ribs (text-figs. 223, 225, & 227). When the shell is small, say below 20 mm., there are a large number of fine ribs, 12–14 of these being slightly more distinct than the others. When the shells grow bigger these 12–14 ribs cease to be at all prominent, and the surface becomes covered by small fine ribs, all more or less equal in size. In rough shells, on the other hand, the outline of the rim is irregular, and some of the ribs are much more prominent than the rest (text-figs. 224, 226, & 228). Rough shells of 9–15 mm. in length have only 12–14 ribs. Shells of larger size have these 12–14 ribs, and usually a few more, very prominent, together with minute ribs in between the principal ribs.

Rough shells are usually heavier and thicker than smooth shells, and the thickening of the rim takes place earlier in them.

The differences between the two types are most evident in medium-sized shells and tend to become obscured in large shells by the effects of weathering and erosion. Small specimens of the smooth type sometimes have their shells gaily coloured with little radiating streaks of white and red and blue, but the general colour of large smooth shells is dark green or brown. Rough shells are coloured in various shades of brown and grey, the ribs being usually tinged with reddish brown.

Effect of Rock Surface on character of Shell.—It is easy to see in a general way that a limpet growing on a smooth surface will tend to have a smooth shell-rim; for the rim of the shell is kept closely applied to the surface of the rock, and so the deposition of shell-material along the rim is to some extent guided by the surface, and must therefore be even. Similarly, if a shell is kept applied in a definite way to a rough uneven surface, its rim must in growth take on an irregular outline, and certain ribs be emphasised while others are checked in their development.

Now in many cases one can observe in rough limpets that the shell is accurately adjusted to inequalities of the rock to which it clings, or to barnacles on the rock, in such a way that the indentations of the rim between the projecting ribs fit closely round the projecting substances. Two or three cases of this adjustment are given above (Section I.), and a few cases noted by other observers may be adduced here. The phenomenon is in fact quite common.

Roberts (**13**) puts on record the following interesting observation of a limpet which he watched returning to its "home." "I watched his course: he arrived, and I immediately perceived a difficulty which he made nothing of, viz., the getting adjusted; he slewed himself round, and fitted a little notch that was in the edge of his shell to a small piece of projecting quartz with wonderful readiness. He was tight in a moment, ready to resist the heaviest breakers or any enemy." The limpet returned daily to the same spot and adjusted himself. Hawkshaw (**8**) says: "On the top of the smooth fractured surface of a pedestal of flint a limpet had taken up its abode. The shell was closely adapted to the uneven surface which it would only fit in one position." Lukis and Lloyd Morgan record similar cases; and this fitting of the margin of the shell to the irregularities of the rock has been observed also in *Acmæa spectrum* Reeve (Willcox, **15**).

An abnormal case which is significant for our purpose is given by Dr. Robertson (**14**):—"A case once came under my notice of a half-grown limpet that had got jammed between the inequalities of two large stones. It obviously had been there for a considerable time, as the shell had grown into a triangular shape to conform to the walls of its prison."

The irregular outline of the rim of the rough type of limpet-shell is therefore probably a mechanical result of the accurate adjustment of the rim of the shell to the inequalities of the rock on which the limpet grows.

Similarly, the regular outline of the smooth shell is due to the rim being moulded during growth by the polished surface opposed to it, and hence becoming smooth and regular.

It is a well-known fact that *Anomia* takes the shape of the surface to which it is adherent: if it grows on a *Pecten* shell it bears the impress of the radiating ribs of the *Pecten*. Just in the same way, *Patella*, since it is very sedentary and stays for months adjusted in one definite way to the inequalities of the surface to which it adheres, takes on at the edge of the shell the shape of that surface; or if the surface be quite smooth, the edge of the shell becomes smooth and regular too.

The difference between the ribs of the two types is to be explained in the same way. All limpets below 15 mm., whether rough or smooth, have about 12 principal ribs. These ribs are very distinct in the rough shell, and project at the rim, giving a very irregular outline to the shell (text-figs. 226 & 228). In the smooth shell these ribs are inconspicuous and hardly project at all, so that the outline of the shell is regular (text-figs. 225 & 227). The specially large ribs of the rough shell arise primarily as projections of the rim, mechanically caused by the irregularities of the rock-surface. These projections of the rim must, owing to the very nature of the shell's growth, be retained during growth, and hence must be continued as ribs. In the smooth shell there is no mechanical formation of projections of the rim, and hence there are no specially prominent ribs.

This case of the rough and the smooth limpet-shell is of interest in that it shows that a small change in an environment may produce through its continuous action a large cumulative result, by a summation of successive little effects. "Continuity" of environment may be apparent only, not real.

References.

(1) Bouchard-Chantereaux.—Catalogue des Mollusques marins . . . . du Boulonnais. Boulogne, 1835.
(2) Cooke, A. H.—Camb. Nat. Hist. iii. (1895).
(3) Davis, J. R. A.—Nature, xxxi. (1885) p. 200.
(4) Idem, *l. c.* li. (1894) p. 512.
(5) Davis & Fleure.—"Patella." Liverpool Marine Biological Committee, Memoir 10 (1903).
(6) Fischer, H.—Journ. de Conchyl. xlvi. (1898) p. 314.
(7) Fischer, P.—Manuel de Conchyliologie. Paris, 1887, p. 867.
(8) Hawkshaw, J. C.—Journ. Linn. Soc., Zool. xiv. (1879) p. 406.
(9) Jeffreys, J. G.—Brit. Conchology, iii. (1865) p. 237.
(10) Lukis, F. C.—Mag. Nat. Hist. iv. (1831) p. 346.
(11) Morgan, C. Lloyd.—Nature, li. (1894) p. 127.
(12) Norman, A. M.—Zoologist, 1860.
(13) Roberts, G.—Ann. Nat. Hist. xix. (1847) p. 70.
(14) Robertson, D.—Trans. Nat. Hist. Soc. Glasgow, new ser. i. (1883–86) p. 9.
(15) Willcox, M. A.—Amer. Nat. xxxix. (1905) pp. 325–33.

4. Contributions to the Knowledge of the Anatomy of the Batrachian Family *Pelobatidæ*. By Frank E. Beddard, M.A., F.R.S., Prosector to the Society.

[Received September 26, 1907.]

(Text-figs. 229–240.)

Contents.

(1) Introductory.

In a recent communication to this Society * I dealt with a number of points in the anatomy of a Frog apparently identical with *Ceratophryne nasuta* of Schlegel (=*Megalophrys nasuta* auct.). I was unable at the time to compare this frog with any other member of the family Pelobatidæ, save only *Pelobates fuscus*. Since then Sir E. Ray Lankester has been so good as to entrust to me for study one example each of *Megalophrys montana*, *Xenophrys monticola*, and *Leptobrachium hasseltii*. I am able, therefore, in the present communication to the Society, to express some opinions with regard to the family Pelobatidæ and the interrelationship of some of the genera or alleged genera belonging to that family. The three genera with which I deal in this contribution were admitted as such by Mr. Boulenger in his 'Catalogue of the Batrachia Salientia' †, and have been quite recently accepted (with the exception of *Xenophrys*) by Dr. Gadow in the volume of the 'Cambridge Natural History' devoted to Reptiles and Amphibia ‡. Mr. Boulenger himself, however, previously to the publication of the last-mentioned work, had expressed the view that it was impossible to retain both the genera *Xenophrys* and *Leptobrachium*, and therefore merged the former in the latter §. This alteration was due to the discovery of *Megalophrys feæ*, a frog showing the general structure of *Leptobrachium*. It was originally referred to *Megalophrys*, partly at least on account of the projections of horny skin above the eyes, which are met with in all of the previously known species of *Megalophrys*. Mr. Boulenger did not, however, as I understand him, combine all the three genera with which I deal in the present paper, viz. *Megalophrys*, *Xenophrys*, and *Leptobrachium*, into one genus. But my own observations upon *Megalophrys nasuta*, to which I have referred,

* P. Z. S. 1907, p. 324.
† London, 1882, p. 443.
‡ Vol. viii. London, 1901, p. 161.
§ Ann. Mus. Genova, ser. 2, iv. p. 512, vii. p. 750.

seem to me to render desirable a revision of the anatomical characters of these various genera and species of Pelobatidæ. At present it would almost appear that *Megalophrys nasuta* is more different from *Megalophrys montana* than the latter is from either *Xenophrys* or *Leptobrachium*. The external resemblance too between the last three—particularly between *Megalophrys montana* and *Xenophrys monticola*—are quite as striking as the differences which all of them show to *Megalophrys nasuta*.

(2) Some Notes upon the Anatomy of *Megalophrys montana*.

So far as I am aware, our knowledge of the structure of this frog is at present confined to the external characters, to such osteological characters as have been used for classificatory purposes by Cope and Boulenger, and to the sternum, which has been figured and described by Prof. Parker *. Quite recently the tadpole has been reported upon by Mr. Laidlaw †, who quotes an account by Prof. Max Weber. The tadpole, with its curious funnel-shaped hood, has been figured by Dr. Gadow ‡. As to the adult frog, I have been able to compare its structure with its congener (or, I perhaps ought to say, alleged congener) *Megalophrys nasuta*, on the anatomy of which I have lately contributed an account to this Society §.

The specimen upon which I report here was kindly placed in my hands by Sir E. Ray Lankester from the stores of the Natural History Museum. It shows in most respects the characters of the species as given by Mr. Boulenger in his 'Catalogue of the Batrachia Salientia' ‖. I find, however, one rather important difference. Mr. Boulenger uses the phrase "tympanum hidden" as part of his generic definition of *Megalophrys*. This undoubtedly applies to *M. nasuta* ¶, as I have been able to ascertain for myself. Subsequently ** Mr. Boulenger himself found a distinct tympanum in *M. longipes*. I have now to record that the tympanum is distinctly visible in *M. montana*, where, however, it is decidedly more obvious when the animal is dry. It is 4 mm. in diameter and is distant from the eye twice its own diameter.

Another rather salient difference between the two species which is hardly apparent from Mr. Boulenger's definition, concerns the tubercles of the body. I have no doubt that these may offer differences from individual to individual in *Megalophrys montana*; but, as I have already pointed out, there are some reasons for believing that these tubercles do not differ much in different specimens of *Megalophrys nasuta*: so that, in any case, they can

* 'Monograph of the Shoulder-girdle,' Ray Society, 1869.
† "The Frogs of the 'Skeat' Expedition," P. Z. S. 1900, p. 890.
‡ 'Cambridge Natural History,' Reptiles and Amphibians, p. 60.
§ P. Z. S. 1907, p. 324. ‖ P. 442.
¶ I have carefully re-examined my specimen and find the barest indication of the tympanum.
** P. Z. S. 1885, p. 850.

be contrasted in the two species. In *Megalophrys montana* they are much more numerous than in the other species. On the head, however, I only found two, and this is not very different from the three tubercles found on the head of *M. nasuta*. On the back and sides there are a considerable number in *Megalophrys montana*. They are perhaps rather less conspicuous than those of *M. nasuta*; but this is partly a matter of the smaller size of *M. montana*. Furthermore they present the appearance of sessile barnacles, owing to their variegated colour and radially arranged grooves; this, however, is possibly merely a matter of shrinkage of the skin.

§ *Abdominal Viscera.*

The liver of this species is on the whole like that of *M. nasuta*. The right lobe is much the smaller, and the left lobe consists of two halves, of which the larger completely covers the more dorsally placed and smaller portion. In *Megalophrys montana* there is no distinct ring-like thickening, marking off the pyloric end of the stomach from the duodenum, such as occurs in *M. nasuta* and is there very pronounced. The alimentary viscera, however, do not vary greatly among the Pelobatidæ.

Certain features in the muscular anatomy of this Frog as compared with its alleged congener are dealt with in the ensuing section of the present paper, where they are more conveniently treated of. Broadly speaking, *Megalophrys montana* agrees with *M. nasuta* in those peculiarities of myology which I have already pointed out as differentiating *Megalophrys* from *Rana* *.

§ *Lungs.*

The lungs of this species are interesting from more than one point of view. In describing those organs in *Megalophrys nasuta* I pointed out that this Frog differs from *Rana* by the fact that the right lung is attached to the liver and the membrane bearing the bile-ducts &c., by a ligament which extends much further down the lung than it does in *Rana*. A portion of the lung, however, towards the free tip is not attached by a part of this ligament, which ceases at some little distance from the tip. *Megalophrys montana* shows a condition of the pulmonary ligament which is an exaggeration of the conditions found in *M. nasuta*. The pulmonary ligament in fact extends to the very end of the lung. Moreover, as in *M. nasuta*, there are two ligaments, of which one is attached as mentioned while the other is fixed to the dorsal body-wall. At their insertion on to the lung these two ligaments are continuous at one point. It follows, therefore, that a part at least of the lung is hidden away in a chamber of the cœlom which is cut off from the general cœlom of the abdominal cavity. This is obviously a step in the direction of the

* P. Z. S. 1907, p. 348.

complete enclosure of the respiratory organs in their own cœlomic chamber.

§ *Shoulder-girdle.*

The shoulder-girdle of my example of *Megalophrys montana* agrees generally with W. K. Parker's * figure of the same. But there are differences to be recorded. The right coracoids overlap the left considerably more than they are represented to do in Parker's figure, and more than is the case with *Megalophrys nasuta* according to my own observations. The thin edge of the cartilage in question quite covers the pectoral muscles of the left side at their origin, which can be seen through the thin transparent blade of cartilage. The omosternum may be, perhaps, rather larger than Prof. Parker has figured, but it is distinctly more rudimentary than in *Megalophrys nasuta*, where it is calcified and has a more distinctly *Rana*-like form. However, slips of the muscular system of the shoulder are attached even to this flat and very thin omosternum in *Megalophrys montana*.

The sternum of the example of *Megalophrys montana* which I have examined does not agree in every detail with the figure by Parker of the same species. The bony style of which the sternum mainly consists is a much more slender style in my example than would be surmised by an inspection of Prof. Parker's figure. I find that the measurements of this part of the sternal apparatus are as follows:—The total length of the style is 13 mm. The diameter at the front end is 4 mm.; in the narrowest part of the style it is less than 1 mm. in breadth. The end of the sternum, where it terminates in a cartilaginous "epiphysis," is about $1\frac{1}{4}$ mm. in diameter. It is clear from Prof. Parker's figure that the sternum of his example was distinctly different and stouter and shorter than my specimen. Still, on the whole there is plainly a substantial agreement. The cartilaginous end of the sternum is not at all rounded in my example. It ends squarely, and is of no greater diameter than the bony part immediately preceding it. There is absolutely no approach to the rounded cheesecutter-like end of the sternum, as it is portrayed in Prof. Parker's figure. In all of these points the present species differs markedly from *Megalophrys nasuta*.

The proportions of this part of the skeleton are, moreover, rather different in the two Frogs. The length of the sternum in *Megalophrys montana* has been mentioned. As the frog itself measures 72 mm. from the tip of the snout to the vent, the length of the sternum is very nearly one-sixth of that length. On the other hand, in *Megalophrys nasuta*, which measured at least 135 mm. in length, the sternum proper had a length of 36 mm. from end to end. The proportion is here obviously rather different. The sternum is plainly shorter and more like a quarter of the total body-length. As to the sternum itself, in *Megalophrys*

* 'Monograph of the Shoulder-girdle,' Ray Soc. 1869, pl. vi. fig. 8. On p. 78 he says that "the *left*, normally, overlaps the *right*" (italics mine).

nasuta I have already described its general characters. The proportions of the length to the breadth of the bony shaft in its narrowest region do not appear to differ greatly from those of *M. montana*. The diameter was rather more than 1 mm., perhaps $1\frac{1}{2}$ mm., about a twenty-fourth part therefore of the length. This is not widely different from the proportions exhibited by *M. montana*.

§ *Hyoid and its Musculature.*

I reserve for later discussion * certain facts relative to the hyoid cartilages and the muscles attached thereto. In this place the differences between the two Frogs assigned both of them to the genus *Megalophrys* will be considered. In examining the hyoid cartilages one obvious difference will be seen to distinguish the present species from *Megalophrys nasuta*. In the latter (*cf.* the figure illustrating my paper upon that Pelobatid †) the two *processus anteriores* of the body of the hyoid run anteriorly on the whole parallel to each other, with but a slight inclination towards the middle line, *i. e.* towards each other. Their extremities are in fact separated by quite 9 or 10 mm. across the middle line of the throat. In *Megalophrys montana* the processes in question, as in *Pelobates* and *Pelodytes* ‡, incline greatly towards each other and are finally only separated by the space of 1 mm. or but slightly more.

§ *Œsophageal Portion of the Transversalis Muscle.*

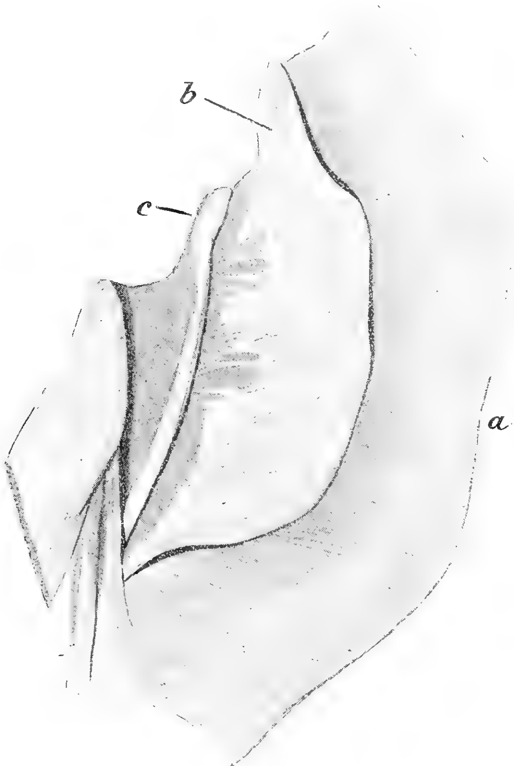
This muscle is quite as conspicuously developed in *Megalophrys montana* (text-fig. 233, p. 886) as it is in *M. nasuta*. But there are certain differences in detail between these two species. Anteriorly at the septum defining the abdominal cavity (the cervical aponeurosis) its fibres lie side by side with those of the obliquus externus, and no line of division can be detected between the two muscles. Continuing on an imaginary line from the point where the two muscles are really distinct, it would appear that the transversalis is only inserted upon the œsophagus and is not connected with the cervical aponeurosis or the lungs at their root. The oviduct runs across it; but I cannot find that any of its fibres are deflected into the membrane supporting that tube. The muscle is pretty stout and fairly thick. Crossing the anterior end of the pelvis, and of course the ilio-coccygeal muscle arising therefrom, not far from its anterior end, as shown in the accompanying figure (text-fig. 233, p. 886), the fibres of the transversalis gather themselves together to form a thicker tract of the muscle like the laths in the handle of a fan. This is the origin of the muscle, and it passes back for a considerable distance completely free of the ilium, to be finally attached away from that

* *Infrà*, p. 892. † P. Z. S. 1907, p. 341, text-fig. 97.

‡ See figs. by Boulenger in 'Tailless Batrachia of Europe,' and Ridewood, P. Z. S. 1897, pl. xxxv.

bone for a long way behind its anterior extremity. This appears to be the only origin of the œsophageal muscle; it has no connection whatever with the transverse processes of any vertebræ anterior to the ilium, so far as I have been able to ascertain. In re-examining *Megalophrys nasuta* for purposes of comparison with the present species, I find that my description is correct, but not sufficiently detailed for purposes of accurate comparison with the

Text-fig. 229.



Left ilium and adjacent musculature of *Megalophrys nasuta* from the ventral surface. The ilio-coccygeal muscle (to the left of the figure) is cut across obliquely.

a. Obliquus muscle. *b*. Œsophageal muscle. *c*. Long muscle of ilio-lumbar complex.

muscle of *Megalophrys montana*. In *Megalophrys nasuta* the transversalis muscle of the œsophagus arises from the pubis, as I have already stated. The exact mode of connection is shown in the figure annexed hereto (text-fig. 229), and will be seen to be not very different from that of *Megalophrys montana*.

The muscles in question are represented from the ventral surface. The ilio-coccygeal is cut across obliquely. The ilium is seen clearly, and to the outside of it runs the narrow muscle belonging to the ilio-lumbar complex which I have had occasion to describe as probably characteristic of the Pelobatidæ. Outside of this again is seen the broad and thin transversalis muscle with its cut edge divided across its fibres, *i. e.* parallel to the long axis of the body of the frog. Outside this, again, is the obliquus muscle. It will be seen that the transversalis is not fan-shaped and that its fibres are nowhere collected into a thick bundle as in *Megalophrys montana.* On the contrary, the muscle obviously ends in a series of digitations near to the end of the obliquus fibres, and these are connected with the pubis only indirectly by the tendinous aponeurosis represented in the drawing referred to (text-fig. 229). The insertion of the transversalis on to the aponeurosis is a very long one: it reaches, in fact, a little way anteriorly to the pubis and back nearly as far as the symphysis.

In both species therefore the attachment of the transversalis muscle lies outside of the long ilio-lumbar muscle, which, I may take this opportunity of remarking, is just as well developed in *Megalophrys montana* as it is in *M. nasuta.* Nor is there, so far as I could see, any attachment to any vertebræ comparable to the equivalent of this muscle in *Rana*, *Ceratophrys*, &c. In fact, in *Megalophrys* the transversalis seems to have preserved a primitive arrangement as one of the covering sheets of the body unconnected directly (only through aponeurosis) with any bones. A further specialisation of this muscular sheet would lead to the conditions observable in *Rana* &c. on the one hand, and in *Pipa* and *Xenopus* on the other. There are in fact no reasons that I can detect from an examination of the transversalis and neighbouring muscles in *Megalophrys montana*, for separating it widely from its supposed congener *Megalophrys nasuta.*

The following is a tabular statement of the differences existing between the two species. The resemblances I shall point out later, when considering the allied forms *Xenophrys* and *Leptobrachium.*

Megalophrys nasuta.	*Megalophrys montana.*
(1) Tympanum invisible.	Tympanum quite distinct.
(2) Palpebral processes very large; "nose-leaf" present.	Palpebral processes small; "nose-leaf" rarely present.
(3) Conical tubercles on back only three.	Conical tubercles numerous.
(4) Index finger considerably longer than second.	Index finger only just longer than second.
(5) Vomerine teeth between choanæ.	Vomerine teeth behind choanæ.
(6) Omosternum less rudimentary. Sternum one fourth body-length, with large posterior cartilaginous epiphysis.	Omosternum more rudimentary. Sternum one third body-length, with small posterior cartilaginous epiphysis.
(7) Vertebræ procœlous.	Vertebræ opisthocœlous *.
(8) Sacral vertebra completely fused with coccyx.	Sacral vertebra articulating with adjoining coccyx.
(9) Anterior processes of hyoid parallel.	Anterior processes of hyoid convergent.

* I have verified these facts in the case of the specimen described here.

(3) On *Xenophrys* and *Leptobrachium*.

Of these two genera I have examined, as already mentioned, the species *Xenophrys monticola* and *Leptobrachium hasseltii*. The external characters of both are described in some detail by Mr. Boulenger in his 'Catalogue,' and later in the 'Fauna of British India,' 1891, and I have identified upon my specimens every characteristic mentioned by him. There are, however, a few—very few—minutiæ with which he does not deal. As already mentioned, the external resemblances between *Megalophrys montana* and *Xenophrys monticola* are very close. The interorbital region is, however, distinctly more concave in the *Megalophrys* than in the representatives of the two other genera. Mr. Boulenger has remarked the large triangular mark between the eyes (which does not exist in *Leptobrachium hasseltii*) in *Megalophrys montana* and *Xenophrys monticola*. I may add that this has a straight anterior margin in the latter species, but is deeply concave in *Megalophrys*. The "V-shaped linear raised fold on the nape" is very plain in *Xenophrys monticola*; but that species has also—and Mr. Boulenger* does not mention this—on each side a lateral longitudinal fold, exactly as in *Megalophrys montana*. In the latter species the equivalent of the V-shaped glandular fold is accurately transverse†. But there is in these folds a close likeness between the two species referred to, and they are totally absent in *Leptobrachium hasseltii*. I have observed another minute feature in which my species of *Megalophrys* and *Xenophrys* agree to differ from the species of *Leptobrachium* which I have studied: in the last-mentioned frog the gape of the mouth only just reaches the anterior margin of the tympanum; in the other two it extends rather beyond this point. The example of *Xenophrys monticola* which I have examined and described does not, it would appear, quite agree with those examined by Boulenger at the time when he drew up his 'Catalogue.' He writes under the generic definition of *Xenophrys*: "Tympanum scarcely distinct," and again, under the specific description of *Xenophrys monticola*: "tympanum slightly distinct, vertically oval, about two thirds the width of the eye." In my example the tympanum was particularly distinct owing to its enclosure within a very strongly marked raised rim continuous above with the fold leading from the eye to the shoulder. Another feature of likeness between *Megalophrys montana* and *Xenophrys monticola* is in the metatarsal tubercle. Boulenger correctly states of both species that this tubercle is indistinct. This statement may be amplified by noting the additional fact that the metatarsal tubercle has the same elongate oval form and comparatively large size in both of these frogs, which is very different from the small and prominent and nearly round tubercle of *Leptobrachium hasseltii*.

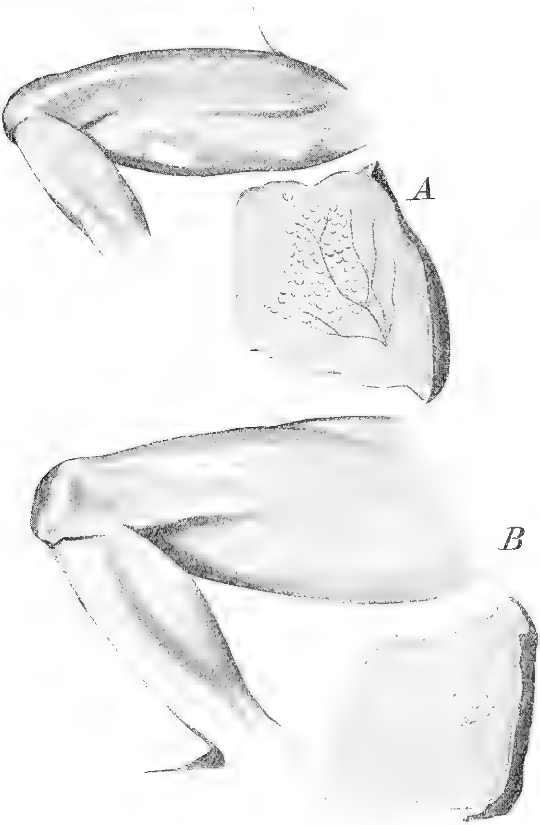
An external character to which but little attention has been

* Dr. Anderson (P. Z. S. 1871, p. 201) appears to have noticed it.

† It is, however, V-shaped in *Megalophrys longipes* (P. Z. S. 1885, p. 850).

paid is a patch of glands upon the thigh *. These are really not clear until the skin has been removed from the subjacent muscles

Text-fig. 230.



A. The thigh (upper figure) and detached fragment of skin more highly magnified (lower figure) of *Xenophrys monticola*, to show the "thigh-gland." In the upper figure the gland is shown as a large white patch with a few isolated and scattered glands near it. In the lower figure the composition f the gland from a number of aggregated simple glands is shown. It is here seen from the lower surface.—B. Corresponding parts of *Megalophrys nasuta* of the same proportional size.

and then inspected upon its lower surface. That is to say, the individual glands are not clear, for the patch as a whole is marked

* Mr. Boulenger, in his more recent definition of *Xenophrys monticola* (Reptilia and Batrachia in 'The Fauna of British India,' 1890, p. 510), does not refer to the gland-patch on each thigh.

by its white colour contrasting with the surrounding brown integument. There are also scattered glands upon the thigh and elsewhere; but only this one large patch which lies on the dorsal surface near to the posterior border of the thigh. In *Xenophrys monticola* this aggregation is 7 mm. in length and is at about the middle of the length of the thigh. In *Leptobrachium hasseltii* the patch is nearer to the knee and of about the same relative size. In both species of *Megalophrys* the gland-patch is present, but it would be easily overlooked if the skin were only examined from the outside; for it is considerably smaller both actually and relatively than in the last two genera. It lies not far from the middle of the length of the thigh. These differences of size may of course be sexual. I could not find any such patch in *Pelobates*.

§ *Abdominal Viscera.*

The *liver* in *Xenophrys* differs from that of both species of *Megalophrys* in the greater extension backwards of the larger left lobe. This lobe almost conceals the junction of the stomach with the duodenum. Its posterior margin is cleft into three conical processes; the left lobe is, as usual, subdivided into two lobes, of which the smaller and distinctly bifid lobe is completely hidden by the larger and superficial subdivision of the lobe. It is not completely hidden in *Megalophrys nasuta*, and apparently not in *M. montana*, though here what appears to be a fusion between the two subdivisions of the left lobe somewhat masks their relations. The *gall-bladder* is not entirely concealed by the right lobe of the liver in *Xenophrys monticola*.

In *Leptobrachium hasseltii* the liver is a little different from that of *Xenophrys monticola*. In the first place it does not extend nearly so far back over the stomach, and is thus more like *Megalophrys*. It also differs greatly from the liver of *Xenophrys* in the approximately equal points to which the two lobes extend posteriorly; this seems to be largely due to the greater size (as compared with other genera) of the right lobe which completely covers and conceals the gall-bladder. Furthermore, the two subdivisions of the (larger) left lobe barely overlap and the lower lobe is thus practically fully exposed. This is an exaggeration of what is met with in *Megalophrys nasuta*.

The *pancreas* of *Xenophrys monticola* agrees pretty closely with that of *Leptobrachium* and of *Megalophrys* as recently described by myself *. I should mention that in these genera a slender branch of the pancreas lies in the fold of mesentery which connects the stomach and duodenum. In neither *Xenophrys* nor *Leptobrachium* could I detect any marked division between the stomach and duodenum, such as is found in *Megalophrys nasuta*.

* P. Z. S. 1907, p. 349.

§ *Lungs.*

The suspension of the lungs in *Xenophrys monticola* is more like what is found in *Megalophrys nasuta* than in *M. montana*. On the right side, the lung is attached to the liver by a membrane which extends fully halfway down the lung and ends upon the vena cava at its entry into the liver, being attached also of course to the liver anteriorly to this point. There is also a membrane binding the lung to the dorsal median line and arising from the lung in common with the pulmo-hepatic ligament. The corresponding ligament on the left side of the body has a line of attachment of the same length to the left lung. *Leptobrachium hasseltii* agrees rather with *Megalophrys montana* than with the other types. For the pulmo-hepatic ligament of the right side is attached to a point further back along the vena cava than in *Xenophrys*, and almost, if not quite, to the end of the lung. In *Pelobates* the lung is attached by a well-developed pulmo-hepatic ligament, which however is not longer than in *Xenophrys*.

§ *Uro-genital Organs.*

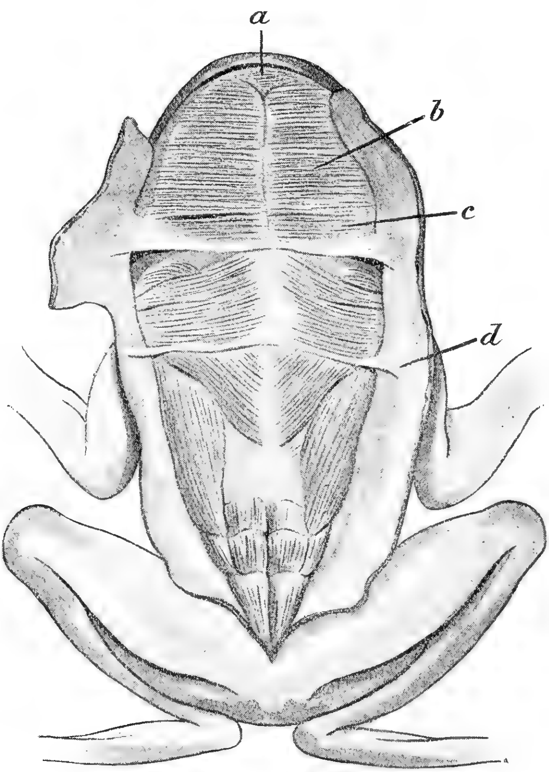
The *kidneys* both of *Xenophrys* and *Leptobrachium* are smooth glands very much like those of *Rana*. I emphasise this fact because the kidneys of *Megalophrys nasuta*, which I did not describe in my account of the anatomy of that Frog, are very different in appearance from those of its allies. And, I may take this opportunity of stating, the kidneys of *Megalophrys montana* are on the whole like those of its congener. In both these species in fact the kidney is broken up into three or four large, almost disconnected lobes, and the general appearance of the organ therefore contrasts very much with that of the kidneys of *Xenophrys* and *Leptobrachium*, which are flat and smooth with an even surface.

The *Xenophrys* which I studied was a fully adult male, that is to say, the testes measured respectively 11·5 (right) and 9 (left) mm. The right kidney possessed four vasa efferentia, forming no rete; two of them bifurcated before reaching the kidney. In an adult *Pelobates fuscus* each testis had six vasa efferentia. It has been recorded that the male *Pelobates fuscus* has no vesicula seminalis. This structure is also absent from the ureter of *Xenophrys monticola*. It is known that the fat-bodies vary considerably in their degree of development in males of *Rana*. They were very greatly developed in the male *Pelobates* just referred to. In the *Xenophrys*, however, they were most feeble; there were only three digitations on the right side (and I think the same number on the left) which were not attached to the anterior end of the kidney, but to the membrane attaching it to the postcaval vein. In *Leptobrachium* the genitalia were immature. The fat-bodies had many digitations. The mesoarium was partly attached to the dilated end of the oviduct, as I have described in *Megalophrys* *nasuta*. I am uncertain whether a definite diverticulum of the expanded termination of the oviduct exists; there was, however, the appearance of such, accentuated doubtless and indeed perhaps caused by the taut condition of the ligament in question.

§ *Ventral Musculature.*

The ventral musculature of *Xenophrys* differs from both that of *Rana* and that of *Megalophrys nasuta*. The general disposition of the muscles, exposed by the removal of the skin of the ventral

Text-fig. 231.



Ventral musculature of *Xenophrys monticola*.

a. Submentalis muscle. *b*. Submaxillaris. *c*. Subhyoideus. *d*. Posterior septum of lymph-sac lying upon the pectoralis muscle.

surface, will be rendered plain by the accompanying figure (text-fig. 231). The abdominal portion of the pectoralis seems to be precisely as in *Rana* and *Megalophrys*. It is of considerable size much larger than in *Leptobrachium* (to be described presently), and arises from the second tendinous intersection of the rectus abdominis, and from the fascia covering that muscle for some way anterior to that point. The pectoralis anterior (or pars epicoracoidalis) arises as usual from the surface of the coracoid cartilage. In front lies the pars episternalis of the deltoid, which also receives fibres from the small omosternum; nothing superficial can be possibly distinguished as a separate sterno-radialis such as is found in *Rana*. The pectoralis posterior (or pars sternalis) is more like that of *Rana* than it is like that of *Megalophrys nasuta*, for it extends in its origin down the whole of the bony shaft of the sternum up to the expanded xiphoid plate, which line of origin is of about the same length as that of the pectoralis anterior. In *Megalophrys nasuta* this muscle does not reach in its line of origin beyond the expanded anterior end of the bony sternum. With regard to these muscles I have also examined *Megalophrys montana*, though they were much hardened and stuck together and thus difficult to discriminate. I believe, however, that I am able to assert that this species presents characters which are intermediate between the two extremes already referred to. For the origin of the pectoralis posterior extends some way down the bony style of the sternum, in fact for about half its length.

I could find no pectoralis cutaneus in *Xenophrys monticola*, and in this the frog agrees with *Megalophrys nasuta*. The septum dividing the abdominal lymph-space from the pectoral was plain enough; but it was nowhere invaded by or connected with slips of muscle arising from or near the pectoralis abdominalis.

The considerable extension backwards of the sternum in *Xenophrys* as in *Megalophrys* reduces the posterior (*i. e.* poststernal) region of the rectus abdominis muscle. In *Xenophrys monticola* the third intermuscular septum of the rectus abdominis lies on a level with the end of the xiphoid cartilage of the sternum, there being thus only three segments of this muscle lying behind the sternum.

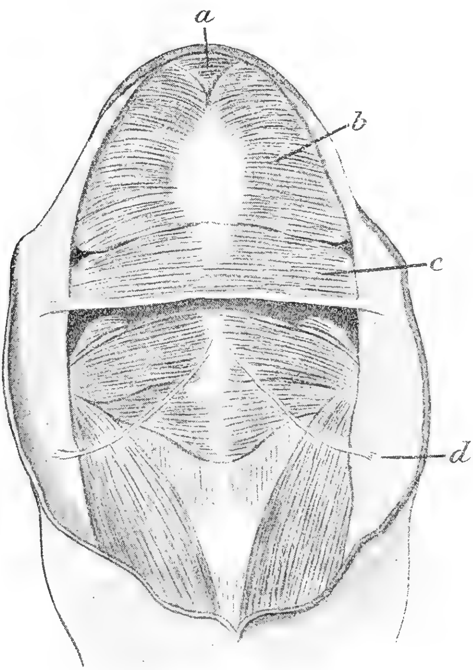
The throat region of *Xenophrys monticola* agrees more closely with the corresponding region in *Rana* than in the, in other respects, more nearly allied *Megalophrys*. The proportions between the submaxillaris, the subhyoideus, and the submentalis appear to me to be exactly as has been figured in *Rana esculenta*. I may mention that the subhyoideus of both *Megalophrys nasuta* * and *M. montana* is relatively a much larger muscle. Furthermore, the median raphe between the two halves of the submaxillaris and subhyoideus is a mere streak.

The ventral musculature of *Leptobrachium hasseltii* presents considerable differences from that of its ally *Xenophrys monticola*, and is in more than one respect much more like that of *Megalophrys*. It differs, however, from all these frogs in two very salient points which are visible when the ventral integument is reflected.

* P. Z. S. 1907, p. 340.

The shortness of the sternum considered relatively to the length of the sternum in other genera results in a much longer post-sternal rectus abdominis, while the pectoralis appears to be short, again relatively speaking. The second point of difference concerns the course of the sheet of membranous tissue which separates the abdominal from the pectoral lymph-space. In *Xenophrys* and in *Megalophrys nasuta* this is almost transverse to the longitudinal axis of the body, being slightly convex anteriorly; it hardly reaches the pectoralis abdominis. In *Leptobrachium*, on the other hand, the attachment of this membrane is **V**-shaped with the apex of the **V** directed anteriorly; it passes over the pectoralis abdominis to near the middle of which it is attached.

Text-fig. 232.



Ventral musculature of *Leptobrachium hasseltii*.

Lettering as in text-fig. 231.

However, in this genus, as in those already treated of, there appears to be no pectoralis cutaneus. The pectoralis anterior seems to be exactly like that of *Xenophrys*, and I could detect no trace of a separate sternoradialis muscle. The pectoralis posterior, on the other hand, is not like that of *Xenophrys*. For it arises along a line which extends halfway down the bony style of the sternum, and thus more closely resembles the same muscle in *Megalophrys montana*.

The throat musculature of *Leptobrachium* (text-fig. 232) does not agree entirely with that of either of the other two genera of Pelobatidæ with which I am concerned in the present communication. I have already pointed out that in the two species of *Megalophrys* (at any rate as commonly held) the subhyoideus is a large muscle as compared with the submaxillaris. The subhyoideus in *Leptobrachium* has exactly the same character. Furthermore, this species, i. e. *Leptobrachium hasseltii*, shows a likeness to *Megalophrys nasuta* in the submaxillaris. I have already pointed out that in *Xenophrys monticola* a mere seam separates in the middle line of the throat the two halves of the muscle. On the other hand, in both *Leptobrachium hasseltii* and *Megalophrys nasuta* this seam is expanded into a widish tendinous sheet. *Megalophrys montana* appears to agree with its congeners in this point. *Leptobrachium*, however, does not agree with *Megalophrys* in the arrangement of the submentalis muscle. In the former genus, and in both species, the submentalis is completely concealed by the fibres of the submaxillaris, the median tendinous interval ceasing some way behind the mandibular symphysis. The fibres of the submaxillaris have to be cut before the submentalis can be seen. The arrangement in both *Leptobrachium* and *Xenophrys* is different from this, and they agree entirely with each other. The submentalis is quite distinct anteriorly near to the symphysis of the lower jaws, not being concealed by muscular fibres of the submaxillaris. The greater part of the submentalis is thus visible; but not its insertions on to each mandible. Moreover, a distinct tendinous seam on each side is seen to divide its fibres from those of the submaxillaris. The two tendinous seams meet to form the median tendinous interval between the right and left halves of the submaxillaris.

So far, therefore, as concerns the superficial muscles of the ventral surface, *Leptobrachium* and *Megalophrys* are more nearly allied than either of them is to *Xenophrys*. The two former agree in (1) the reduced posterior pectoralis, (2) the distinctness and relatively large size of the subhyoideus, (3) the considerable tendinous interval between the right and left halves of the submaxillaris. On the other hand, *Leptobrachium* and *Xenophrys* are alike in the relations of the submentalis to the submaxillaris.

It is interesting to compare the Eastern genera, *Megalophrys*, *Xenophrys*, and *Leptobrachium*, with the essentially European *Pelobates* *. The comparison shows an extraordinary uniformity, so far as the muscular peculiarities already dealt with are concerned, between *Pelobates fuscus* and *Xenophrys monticola*. The pectoralis muscle is identical by reason of the large size of the pectoralis posterior, which extends as far back in its origin as to the posterior end of the bony style of the sternum. The muscles on the floor of the mouth are also identical in the two genera. It is difficult to draw any boundary line between the submaxillaris

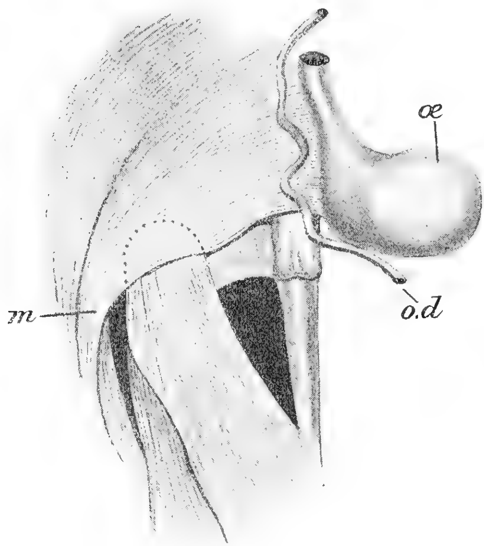
* This genus only extends eastward as far as Asia Minor and Syria.

and the subhyoideus, such as is very obvious in the other two Oriental genera. A fine tendinous seam divides the right and left half of the submaxillaris. This seam also in *Pelobates*, as in *Xenophrys*, bifurcates anteriorly and partitions off the submentalis from the submaxillaris, which is therefore not covered by the latter as it is in *Megalophrys*.

§ *The Transversalis Muscle to Œsophagus.*

This muscle in its large size, place of origin, and insertion, is apparently peculiar to the Pelobatidæ. It becomes therefore of very great importance to ascertain its relations in the genera

Text-fig. 233.



Œsophageal muscle and neighbouring structures in *Megalophrys montana*.

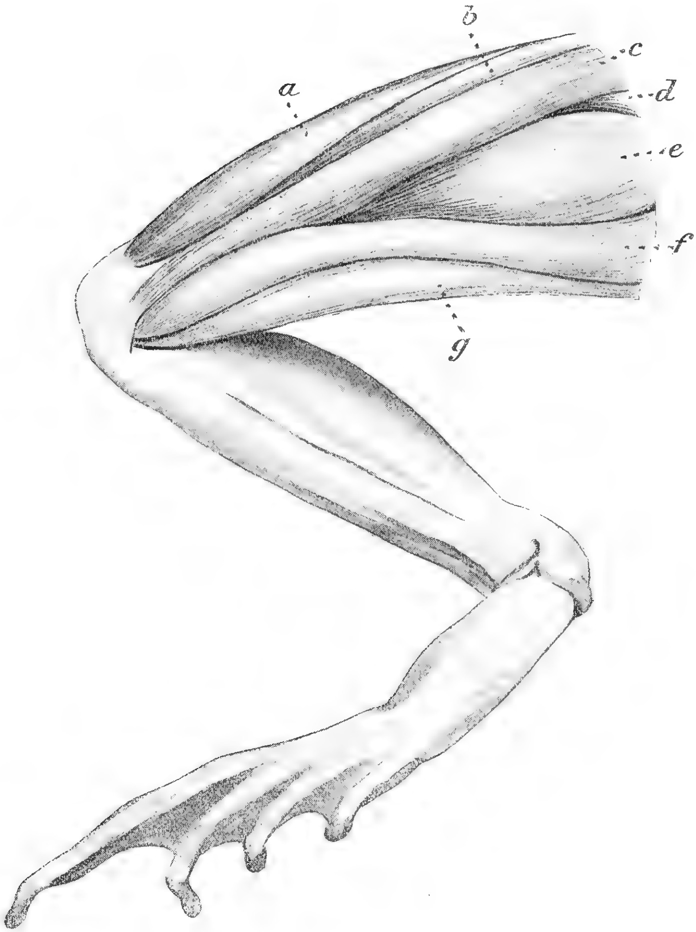
m. The œsophageal muscle at first separate but towards the centre of the figure indistinguishable from the obliquus externus which lies above it; its posterior attachment to the œsophagus is seen to overlie the sacral vertebra, which latter is seen to be free from the ensuing coccyx. *od*. Oviduct. *œ*. Œsophagus.

Xenophrys and *Leptobrachium*. In *Xenophrys* the muscle is very obvious, and without further dissection appears to be precisely as in the genus *Megalophrys*. It occupies the anterior half of the abdominal cavity and has a curved, somewhat excavated posterior border a little in front of the kidney. It seems distinctly thinner in proportion than the same muscle in *Megalophrys montana* (text-fig. 233), a conclusion at which I arrive with greater confidence, since the two frogs were of the same size. I can see no features in the corresponding muscle in *Leptobrachium* which necessitate a particular description of that type. I may take this opportunity of remarking that the pelvic muscles in this region (long strip of ilio-lumbar, ilio-coccygeal, &c.) are in *Xenophrys* and *Leptobrachium* as in *Megalophrys*.

§ *Musculature of the Thigh.*

In comparing the thigh-muscles of the several genera of Pelobatidæ which I describe in the present communication, I have used

Text-fig. 234.

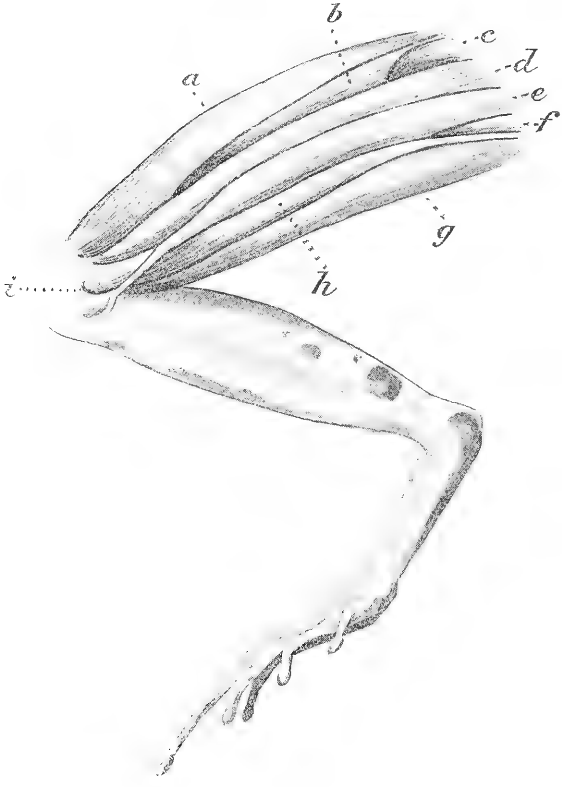


Thigh-muscles of *Rana guppyi* on the inside of the thigh.

a. Vastus internus. *b*. Adductor longus. *c*. Sartorius. *d*. Adductor brevis. *e*. Adductor magnus. *f*. Rectus internus major. *g*. Rectus internus minor.

the conditions obtaining in *Rana guppyi* as a basis of comparison. In using the same species for a comparison with *Pipa* I regret to find that I have made an error as to *Rana guppyi* in a paper communicated to this Society some twelve years since*. There are six muscles visible (text-fig. 234) when the skin is removed from the inside of the thigh. These are precisely as figured in

Text-fig. 235.



Thigh-muscles of *Xenophrys monticola* on inside of thigh.

a. Vastus internus. *b, c, d.* Adductors. *e, f.* Sartorius or sart. and semitendinosus. *g, h.* Recti interni (or gracilis). *i.* Semimembranosus.

Ecker's work upon the Frog†, except for the fact that in *Rana guppyi* the adductor brevis lies between the heads of the sartorius and the adductor magnus, instead of between the latter and the rectus internus major, as figured in *R. esculenta.* When this is

* P. Z. S. 1895, p. 837.

† Engl. Transl. by Haslam, Oxford, 1889, p. 98, fig. 81.

compared with *Xenophrys monticola* some differences are seen. The inner side of the thigh of the latter species is represented in the accompanying figure (text-fig. 235) and there is no doubt about the identification of the three adductors, the two recti interni and the vastus internus. This leaves for identification the two muscles which I have lettered "*i*" and "*e.f.*" The two heads of origin are plainly seen in the case of the latter muscle, while the insertion only of "*i*" is visible. The latter muscle seems to be without doubt the semimembranosus, which in the case of *Rana* does not appear upon the inside of the thigh at all but is quite restricted to the dorsal aspect. It is not without interest to note that in this appearance of the semimembranosus upon the inner surface of the thigh, *Xenophrys* agrees with *Pipa** but not with the Aglossan *Xenopus*†. There remains now the muscle "*e.f.*" This has two heads of origin, of which the posterior is much the smaller and soon joins the anterior head. The superficial position of the muscle and the fact that it is inserted onto the knee superficially to (*i. e.* ventrally to) the insertion of the recti interni, would seem to argue the identity of this muscle with the sartorius of *Rana*, from which it would in that case only differ by its two heads and its more posterior origin, and consequently different position in relation to the other muscles of the thigh. On the other hand, the two muscles end in a well-marked and longish strap-shaped tendon and are totally indistinguishable for some distance in front of their tendinous ending, which would fit in well with the view that we have here, as in *Rana*, a double-headed semitendinosus with a slightly different origin and insertion from that muscle in *Rana*. An obvious third view is to regard the two-headed muscle as actually composed of two muscles which are in course of fusion or of separation, and to compare them with both the sartorius and the semitendinosus of *Rana*. A consideration of the arrangement of these muscles within the family Pelobatidæ offers no clue to the determination of the homologies. For the genera which I have dissected agree with *Xenophrys*.

I have already described the muscles in question in *Megalophrys nasuta*‡, where they are practically the same as in *Xenophrys* except for the additional and slight complication caused by the presence of an additional head to the posterior of the two muscles. *Megalophrys montana* is like *Xenophrys*, and *Leptobrachium hasseltii* only differs very slightly, this difference consisting in a somewhat earlier fusion between the two muscles, whose homologies are under consideration. In *Pelobates* the differentiation of the two was even slighter. If, however, we consider the thigh-muscles in the Aglossa, it is possible, as I think, to arrive at a reasonable conclusion concerning these muscles in the Pelobatidæ. In *Pipa* § the same two muscles that are present in the

* P. Z. S. 1895, p. 838, fig. 4. † *Ibid.* p. 844, fig. 3.
‡ P. Z. S. 1907, p. 343.
§ P. Z. S. 1895, p. 838, woodcut, fig. 4, 3, 4.

Pelobatidæ are present, and have the origin, course, and insertion as in *Megalophrys*, &c. They are completely superficial and visible on the internal aspect of the thigh only. There is no deeper muscle which could correspond to the semitendinosus of *Rana*. I find on a dissection of another example of *Pipa* that the insertion of the muscles (at any rate in that individual) is a little different from my description of the same in the paper already referred to. The two muscles are free from each other at their origin and also for the greater part of their course—and in this they differ from the corresponding muscles of the Pelobatidæ—but unite to form a common tendon which interposes itself between the two recti interni muscles (or gracilis), and is therefore inserted ventral of one and dorsal of the other. In spite of these differences, it is I think reasonable to assume that there is an homology between these muscles in *Pipa* and those which have just been described in the above-mentioned genera of the Pelobatidæ. This resemblance is in itself an interesting fact, and is to be added to those which I have already referred to and shall have occasion to refer to later.

My own observations upon the anatomy of *Pipa* and *Xenopus* and those subsequently published by Dr. Ridewood, which I have occasion to refer to several times in the course of the present communication, have certainly strengthened the opinion that there is a relationship between *Pipa* and *Xenopus* closer than that which ties either of these genera to any other genus *, and that the group Aglossa is fully justified. It is not unreasonable, therefore, to compare the thigh-muscles in the two. I have again dissected *Xenopus* in case any error might have crept into my former account of that Frog, and find that the facts relating to the musculature of the thigh are as I there stated them †. I believe, moreover, that my interpretation of the thigh-muscles of *Xenopus* was more correct than of those of *Pipa*. The sartorius of *Xenopus* is largely fused with the semitendinosus, but has a separate insertion. The loss of this and the reduction in size of the sartorius (from before backwards) would bring about a state of affairs such as exists in *Pipa* and the Pelobatidæ, where the presumed sartorius is not only thinner but has a more posterior origin; the loss of the anterior portion of the muscle in *Xenopus* would obviously bring about such a result. These suggestions are of course based upon the supposition that there is likely to be a resemblance in the musculature of *Xenopus* and of *Pipa*. And in any case the views which I have ventured to express seem to me to be the most probable ones. On general grounds one might perhaps be tempted to look for a closer likeness between the Pelobatidæ and the Ranidæ than between the Pelobatidæ and the Aglossa; but the facts which have just been considered afford no basis for a comparison on these lines. Finally, as concerns the thigh-muscles, I may point out that the exposure of the insertion

* Except of course *Hymenochirus*, the third genus of Aglossa.

† P. Z. S. 1895, p. 844.

of the semimembranosus on the ventral side of the thigh occurs in *Megalophrys*, *Leptobrachium*, and *Pelobates* as well as in *Xenophrys*.

The various facts concerning the musculature of the hind limb in the Pelobatidæ, which I have detailed in the foregoing pages, enable us to assign certain characters to that family as a whole, though the existing information upon the Anura generally does not allow at present of formulating a definition of the Pelobatidæ which shall differentiate them from other families, except possibly from the Ranidæ. As opposed to the Ranidæ, the Pelobatidæ, so far as we know them, are characterised by—(1) the appearance of the distal end of the *semimembranosus* (at its insertion) on the ventral surface of the thigh; (2) the fusion of the *sartorius* with the semitendinosus, if that is to say the homologies arrived at above are allowed; (3) the fact that the *semitendinosus* is either a single muscle or, if composed of more than one part (as in *Megalophrys nasuta*), the two heads arise side by side and not at different levels as in *Rana*, and that this muscle is quite superficial and not concealed by the *rectus internus major* or other muscles; (4) the tendon of insertion of the *rectus internus major* runs dorsally of the tendon of insertion of the *semitendinosus*.

§ *Sternum*.

The sternums of *Xenophrys* and *Leptobrachium* are much like the sternums of *Pelobates* * and *Megalophrys* †. There are, however, differences of detail which are worth recording as an assistance towards the determination of the mutual position of the various forms of Pelobatidæ to which generic rank has been given, and which are considered in the present contribution to the zoology of that family. I have already pointed out the great differences in the proportion of the body-length to the sternum in *Megalophrys nasuta* and *Pelobates fuscus* ‡ and in the two species usually referred to the genus *Megalophrys* §. In *Xenophrys monticola* the total body-length from the tip of the snout to the vent was 68 mm.; from the anterior end of the omosternum to the extreme end of the sternum the length was 27 mm., and the true sternum measured 16 mm. In *Leptobrachium hasseltii* the corresponding measurements were 55 mm., 18 mm., and 10 mm. It appears, therefore, that in *Xenophrys* the proportions between these different lengths are not very different from those of *Megalophrys nasuta*; that is to say, the body-length of *Xenophrys* : length of entire sternum : : 10 : 4, while in *Megalophrys nasuta* the proportions are 10 : 4·5. Again, the body-length of *Xenophrys* : length of true sternum : : 10 : 2·3, and the corresponding proportions in *Megalophrys nasuta* are 10 : 2·7. Of *Leptobrachium*

* *Cf.* Boulenger, 'Tailless Batrachia of Europe,' pt. i. p. 197, fig. 75.
† Beddard, P. Z. S. 1907, p. 329.
‡ *Id. ibid.* p. cit. § *Supra*, p. 874.

hasseltii the proportions of body-length to total sternal length (including omosternum) are 10 : 3·2, and of body-length to length of true sternum 10 : 1·8. *Megalophrys montana* clearly comes nearer to *Leptobrachium* than to its congener or to *Xenophrys*, for the two sets of proportions are (in the order adopted) 10 : 3·5 and 10 : 1·7. Translating these numbers into words, *Xenophrys monticola* and *Megalophrys nasuta* fall into one group characterised by a long sternum, while *Megalophrys montana* and *Leptobrachium hasseltii* agree with each other in possessing a short sternum.

In *Pelobates fuscus* the body-length was 47 mm., the total length of the sternal region including the omosternum 16 mm., and the length of the true sternum 9 mm. The actual proportions are therefore, as treated above in the Oriental Pelobatidæ, 10 : 3·4 and 10 : 1·9. These numbers hardly fill up the gap between the Pelobatidæ with a short sternum and those which possess a long sternum; they show that *Pelobates* is referable to the former group. I have already pointed out* that the form of the sternum proper differs in *Megalophrys nasuta* and *M. montana*, especially in the form of the cartilaginous plate in which it ends posteriorly. *Xenophrys* and *Leptobrachium* agree with each other and with *Megalophrys nasuta*, *Pelobates*, &c. in that the xiphisternum is a wide cheesecutter-shaped cartilaginous plate, differing thus from that of *Megalophrys montana*. In neither *Xenophrys* nor *Leptobrachium* does the sternum extend so far as the end of the larger (left) lobe of the liver.

In dissecting the sternal musculature of *Xenophrys monticola* I have noticed a sheet of stiff fibrous tissue which extends laterally along each side of the sternum and overlies the sternohyoideus muscle. This is not an aponeurosis connected with that muscle or with any other muscle. The muscle is quite free from it and unconnected by any fibres. It seems to be an extension of the sternum itself laterally. It may indeed be regarded as morphologically part of the sternum; and, if this suggestion is correct, it brings the sternum of this Pelobatid more into line with that of some other Batrachia Salientia. A broad expanded sternum is, for instance, a character of the Aglossa. This is not urged, of course, as necessary evidence of special affinity with the Aglossa; for other genera belonging to the Phaneroglossa have also a broader sternum than is typical among the Pelobatidæ. It is not, however, at variance with such a view which other facts referred to support.

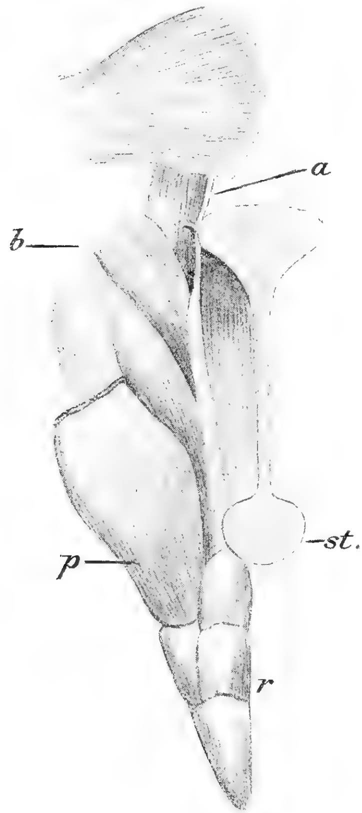
§ *Hyoid Muscles and Cartilages.*

The relations of the rectus abdominis and the sternohyoideus in *Xenophrys monticola* are very unlike those of *Rana* and very like those of *Megalophrys nasuta*. When the pectoralis posterior

* *Supra*, p. 874.

of *Rana guppyi* is cut across and reflected, the sternohyoid is exposed from its origin from the xiphoid end of the sternum up to where it dips under the shoulder-girdle anteriorly to reach the hyoid. In *Xenophrys* (text-fig. 236) the disposition of this muscle is as in *Megalophrys nasuta*, but with some slight differences of detail. When the pectoralis posterior is cut across

Text-fig. 236.



Sternum and adjacent musculature of *Xenophrys monticola*.

a. Specialised tract of rectus abdominis muscle attached by a tendon to border of coracoid. *b.* Scapular portion of obliquus. *p.* Pectoralis abdominalis cut across anteriorly. *r.* Rectus abdominis. *st.* Sternum.

and reflected, the sternohyoid is in the same way brought into view. The sternal portion of it, *i. e.*, that which arises from the xiphoid process of the sternum, runs anteriorly on each side parallel to, and in contact with, the bony style of the sternum. Anteriorly dipping under the expanded anterior end of the sternum and joining the rest of the sternohyoideus, as in *Megalophrys nasuta*, it is covered by an aponeurosis inserted upon the latero-posterior border of the expanded anterior end of the sternum. This here joins the sternal attachment of a portion of the rectus muscle, which muscle I have also referred to as occurring in *Megalophrys*. The attachment of this latter muscle is strongly tendinous in *Xenophrys* as it is in *Megalophrys*. The tendon of this muscle, though attached to the rhomboidal expansion of the sternum anteriorly by a stout tendon, is continued on by this tendon to the posterior border of the cartilaginous and expanded coracoid *. I have on a redissection of *Megalophrys nasuta* ascertained that this is also the case with that Frog. The portio omo-abdominalis of *Rana*, which is also plainly to be seen in *Xenophrys*, and with the same general relations that it has in *Rana*, is not to be confused with the present muscle, which is, as I think, to be regarded as a specialised tract of the rectus abdominis, not represented (at any rate as a specialised muscle) in *Rana*. The corresponding muscles in *Leptobrachium hasseltii* seem to show no differences from those of *Xenophrys monticola*, and there is thus in this region of the musculature an agreement among these Eastern Pelobatidæ.

I have been able to compare these several muscles which agree so exactly among the Oriental Pelobatidæ with those of *Pelobates fuscus*. I find that this species of Pelobatid agrees with its Eastern relatives and thus disagrees with *Rana*. *Pelobates* agrees more closely with *Megalophrys nasuta* than with *Xenophrys monticola* in that the sternal portion of the sternohyoid is not inserted at all anteriorly upon the rhomboidal expansion of the sternum. It can be plainly seen to dip under this (*i. e.*, to pass above it dorsally), and appears to be quite unconnected with it by any fibres at all, and there is no conspicuous aponeurosis. The coracoidal insertion of the rectus is therefore much clearer than in *Xenophrys*, where its relations to the anterior end of the sternum are rather confused by the sternal insertion of the sternohyoideus. The tendon can be seen to pass through a tendinous sling, which runs from the external corner of the anterior end of the sternum to the surface of the rectus muscle just above it, to the posterior border of the coracoid. This is, as I have convinced myself, the actual arrangement in *Xenophrys* and *Megalophrys* as well as in *Pelobates*.

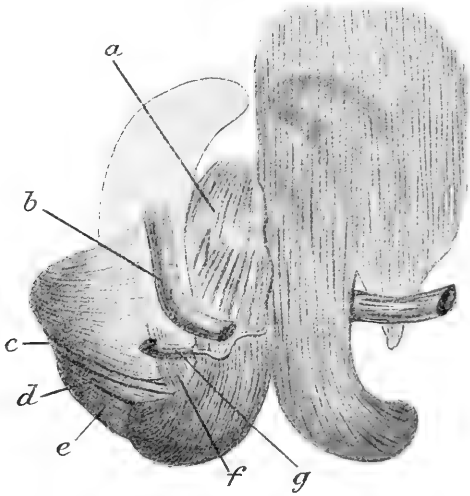
In describing the geniohyoideus muscle of *Rana esculenta*, Dr. Haslam translates † as follows from Ecker's work upon the Frog:—This muscle on each side of the throat "divides posteriorly into two portions. One of these, the median, is inserted into

* The principal attachment of the tendon is really to the coracoid. The attachment to the sternum is rather of a fibrous than a tendinous nature, as in *Pelobates*.

† 'The Anatomy of the Frog,' by Dr. Alexander Ecker. Transl. by George Haslam, M.D., Oxford, 1889, p. 64.

the inner border of the posterior horn of the hyoid bone, and is here attached to a fascia which covers the m. hyoglossus from beneath. By the same fascia the muscles of opposite sides are connected in the space between the two posterior cornua." I quote this description in full in order to emphasise the differences which *Rana* shows from all of the Pelobatidæ examined by myself and described in the present paper. In *Xenophrys monticola*, when the submaxillaris and subhyoideus are cut and reflected, a thin and broad sheet of muscle is seen to occupy the greater part of the area of the throat. This muscle is indistinguishable into two muscles; for, while in *Rana guppyi* (and *esculenta* as figured by

Text-fig. 237.



Some of the hyoid muscles of *Megalophrys montana*. On the right side the processus anterior of the basal cartilage of the hyoid is seen exposed: the corresponding cartilage on the left side (the right-hand of the drawing) is covered by the geniohyoid muscle, through which it appears dimly.

a. Hyoglossus. *b*. Sternohyoid. *c, d, e*. Subdivisions of posterior petrohyoid; the large anterior petrohyoid is seen in front of *c*. *f*. Part of geniohyoid. *g*. Omohyoid.

Ecker) a membranous median interval separates the right and left geniohyoid muscles, allowing the subjacent (*i. e.*, dorsally lying) hyoglossus to be seen through this transparent fascia, the geniohyoideus in *Xenophrys* is indistinguishable anteriorly into two halves, the fascia being represented by muscle. There is then no view of the hyoglossus muscle until the geniohyoid is divided and reflected. Furthermore, when the muscle of each side bifurcates to permit of the passage of the sternohyoideus (as in *Rana*), the two inner portions form a continuous sheet of muscle which covers completely, and has to be dissected away to reveal, the underlying hyoglossus. This same arrangement of the genio-hyoid is quite plain in *Megalophrys montana* and in *Leptobrachium hasseltii*, and apparently in *Megalophrys nasuta*.

The hyoglossus in *Xenophrys* is an extremely stout muscle, arising from the thyrohyals as usual. In cutting the muscle through longitudinally in that part of it which lies on the body of the hyoid, the muscle is seen to be separable into five superjacent layers very plainly distinct from each other. The muscle does not run so far forwards along the floor of the mouth as in *Rana*, and enters the tongue nearer the middle of that organ, which is more attached to the floor of the mouth in the Pelobatidæ than in many other Frogs. This greater adhesion of the tongue is perhaps connected with the spreading and greater extension of the geniohyoideus. In respect of these matters, *Leptobrachium* shows no particular differences that I could discover from *Xenophrys*. In *Megalophrys montana* (text-fig. 237) the only difference appeared to me to be the much more marked subdivision of the hyoglossus into rope-like strands at an earlier period than in the other genera. It is important to notice that as regards the two hyoidean muscles that have been already dealt with, *Pelobates* entirely agrees with its Oriental allies. In dissecting the muscles above described in the several species of Pelobatidæ, certain differences are obvious in the point at which the hyoglossus disappears anteriorly into the tongue from the floor of the mouth.

In some species this point is more anterior in position, in others more posterior. It is curious to remark that *Xenophrys* and *Leptobrachium* offer the two extremes in position. The measurements taken were as follows: from the middle of a line drawn connecting the posterior (articular) extremities of each mandibular ramus another line at right angles was drawn through the mandibular symphysis; this represents the length of the throat; and the point at which the hyoglossus disappears can be measured along this line. The actual measurements in the types examined were as follows:—

	Length of Throat.	Length of Hyoglossus.	Proportion.
Xenophrys	22 mm.	6 mm.	$\frac{3}{11}$ or ·27
Megalophrys nasuta	42 ,,	26 ,,	$\frac{13}{21}$ or ·538
Megalophrys montana ...	22 ,,	14 ,,	$\frac{7}{11}$ or ·63
Leptobrachium hasseltii...	19 ,,	12 ,,	$\frac{12}{19}$ or ·63

It is also noteworthy that *Leptobrachium* and *Megalophrys montana* are nearer together than any other forms, and that the two *Megalophrys* are by no means identical.

The hyoid cartilages of *Megalophrys montana* have been already dealt with to some extent in this paper* as assisting to distinguish

* *Supra*, p. 875.

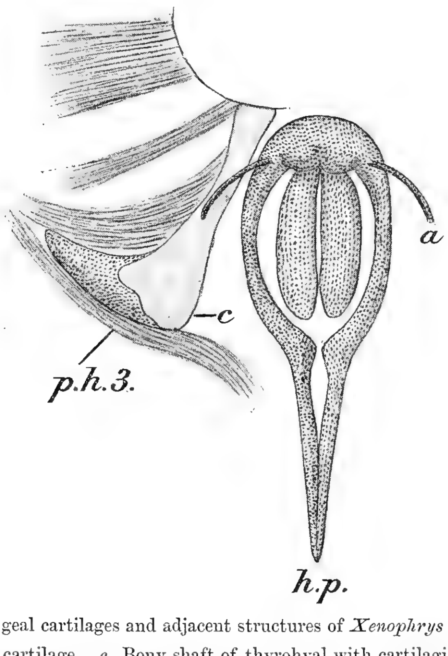
that species from *Megalophrys nasuta*, the hyoid cartilage of which I have already examined and figured *. In comparing the two species alleged to be of the same genus, I pointed out a difference in the curvature of the basal cartilage which happens to be of morphological importance. It is most interesting to find that this undoubted likeness to *Pelobates*, shown by *Megalophrys montana* but not by *M. nasuta*, does not occur elsewhere among the species which I have had the opportunity of investigating. There is a very slight approach to the curvature exhibited by *Megalophrys montana* in the case of *Xenophrys*. But in *Leptobrachium* the *processus anteriores* are directed straight forward parallel with the long axis of the body of the Frog and without the slightest deflection towards each other, as in *Megalophrys nasuta*—not the first point of likeness between these two that I have pointed out in the present paper.

In describing the structure of *Megalophrys nasuta*, I particularly pointed out the large size of the thyrohyals and the immense mass of the investing muscles as characteristic of that Frog when compared with *Rana*. In *Rana guppyi*, a much larger Frog than *Megalophrys nasuta*, the thyrohyals and their investing mass of muscles were absolutely considerably less in size than in the *Megalophrys*. Furthermore, the bones and muscular sheath in question are directed upwards and nearly at right angles to the direction of the body of the hyoid. It appears to me to be justifiable to regard this position of the processes in question as some evidence, though doubtless slight, in favour of considering the processes as the remains of branchial arches—an homology which has been disputed, and is at least not clear. As it is, the direction of these thyrohyals in *Megalophrys* across the throat is, at any rate, the direction of a branchial branch. These two facts concerning the thyrohyals and their musculature in *Megalophrys* apply equally well to the other species of Pelobatidæ considered in the present communication. They all agree in the direction of these processes and in the very thick muscular covering. *Pelobates*, too, agrees with its Eastern relatives entirely. When the thyrohyals are stripped of the investing hypoglossal muscle, the bony shaft is very plainly marked off from the cartilaginous epiphysis, and the insertions of the petrohyoidei posteriores become obvious. In all the types that I have examined the thyrohyals are straight and with a "waist" in the middle. The epiphysis in *Megalophrys montana*, like that of *M. nasuta*, projects boot-like towards the petrous region of the skull. It differs, however, in some degree from the epiphysis of its alleged congener. In *M. nasuta* the epiphysis is attached distinctly to the side—the outer side—of the end of the thyrohyal. The latter bone is bony up to the actual posterior truncated edge. It is, however, cartilaginous at the inner posterior corner. Thus it comes about that the epiphysis is very easily detached. This is not at all the case

* P. Z. S. 1907, p. 341, text-fig. 97.

with *M. montana*. In that Frog the epiphysis (which is straighter and not so curled as in *M. nasuta*) is continuous with the cartilaginous posterior border of the thyrohyal, and is not detachable. In *Xenophrys monticola* there is a slight difference; the cartilaginous epiphysis is easily detachable and is attached to the bony shaft, as is shown in the accompanying figure (text-fig. 238), partly to the side and partly to the posterior border of the thyrohyal. The thyrohyal of *Leptobrachium hasseltii* is quite different from any of the types just described. The bone is straight and narrow at the posterior end. It has not the hourglass-shape that it has

Text-fig. 238.



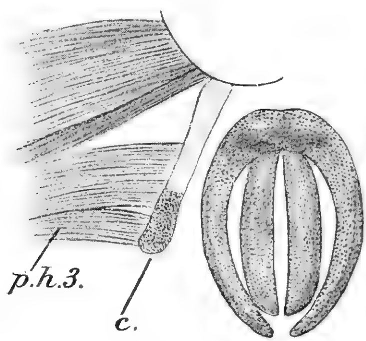
Laryngeal cartilages and adjacent structures of *Xenophrys monticola*.

Bronchial cartilage. *c*. Bony shaft of thyrohyal with cartilaginous epiphysis to left. *hp*. Hypopharyngeal processes of cricoid cartilages. *p.h*.3. Posterior petrohyoid.

in the other genera. It ends in cartilage below, and from this latter is readily detachable by a slighter cartilaginous epiphysis. This region of the hyoid in *Leptobrachium* (text-fig. 239) differs much more from that of *Xenophrys* than the latter genus does in this respect from *Megalophrys*. A final peculiarity of the thyrohyal epiphysis distinguishes *Xenophrys* from both species of *Megalophrys*. In the two latter the epiphysis is distinctly posterior to the petrohyoideus posterior tertius muscle. In *Xenophrys*, on the other hand, this cartilaginous process lies as distinctly in front of the same muscle, in fact between it and the petrohyoideus posterior secundus. I am not quite clear about the exact relations of the corresponding parts in *Leptobrachium hasseltii*.

The petrohyoidei muscles are all four of them present in such Pelobatidæ as I have dissected. The insertions of these (and of the hyoid muscles generally) in *Pelobates* and *Pelodytes* have been carefully figured and described by Ridewood * and compared with those of *Rana temporaria*. He has observed that the fourth division of the petrohyoideus, *i. e.* the petrohyoideus posterior tertius, is absent from *Pelodytes*. As to *Rana* the current figures and descriptions of the hyoid musculature in *R. temporaria* and *R. esculenta* indicate four petrohyoideal † muscles; and I can confirm these statements as applying to *Rana tigrina*. Furthermore, it is plain from the illustrations cited below and from my own

Text-fig. 239.



Leptobrachium hasseltii.

c. Points to cartilaginous epiphysis of thyrohyal. *p.h.*3. Posterior petrohyoid.

dissections, that in these species of *Rana* the three portions of the petrohyoideus posterior are slender, of insufficient width to come into contact at their insertions on to the thyrohyal bone. It must not, however, be imagined that this is distinctive of *Rana*. For in *Rana guppyi* the petrohyoideus posterior is only formed of two separate muscles, which are, however, broad and fanshaped and nearly fill up the entire margin of the thyrohyal at their insertion. The anterior of the two muscles is the larger and clearly corresponds to the primus and secundus; but in two examples of the Frog in which I dissected these muscles I can find no evidence of the fusion of two muscles. In *Rana* generally the three (or exceptionally two) divisions of the petrohyoideus posterior are inserted

* P. Z. S. 1897, pl. xxxv. figs. 10, 11.

† *E.g.*, Ridewood (*loc. cit.*); Wilder, Zool. Jahrb., Abth. f. Anat. ix. 1893, Taf. 20. fig. 35; Haslam in Ecker's 'Anatomy of the Frog,' fig. 60, p. 65. But Göppert (Morph. Jahrb. Bd .xxvi. 1898, Taf. 8. fig. 7) figures only three in *Rana temporaria*.

on to the bony thyrohyal, the anterior slip of the muscle straying only slightly if at all on to the body of the hyoid, as figured for instance by H. H. Wilder *. On the other hand, I have already pointed out that in *Megalophrys nasuta* the first of the three slips of the petrohyoideus posterior arises mainly—and indeed I believe I may say, after a reexamination, exclusively—from the body of the hyoid at its junction with the thyrohyal †. In *Rana* a small slip of the petrohyoideus posterior tertius is not inserted with the mass of the muscle on to the thyrohyal but forms a part of the laryngeal musculature. I could see that this was the case with *Rana guppyi*, where nearly the whole muscle appeared to be inserted on to the thyrohyal, but a few fibres escaped beyond it and appeared to be inserted onto the ligament binding the posterior end of the thyrohyal to the cricoid; I did not trace them beyond this point ‡. In *Megalophrys nasuta* I have described this muscle as passing beneath the end of the thyrohyal § (*i. e.*, beneath when the animal is examined in the ordinary position of dissection). In reexamining the Frog I find that this is the case, but that the muscle is not entirely inserted upon the thyrohyal. In fact, the greater part of the muscle escapes the thyrohyal and is inserted close to the laryngeal apparatus, and only a part is inserted onto the inner end corner of the thyrohyal. We have here in fact conditions precisely the reverse of those sometimes found in *Rana*, the major part of the petrohyoideus posterior tertius being a laryngeal muscle. I may point out that this fact is of some importance embryologically. For, as Wilder ‖ has shown, the petrohyoideus in question is originally a continuous muscle reaching the larynx, part of it in *Rana* becoming later separated as an intrinsic muscle. Furthermore, among the Aglossa it has been shown by Ridewood ¶ that the third division of the petrohyoideus posterior (or rather the muscle believed to correspond thereto) is a purely laryngeal muscle, having no connection with the hyoid. Thus *Megalophrys nasuta* shows a distinct likeness in this anatomical relation—though it is doubtless a small one—to the Aglossa. These same peculiarities of the petrohyoid muscles occur also in the other Oriental Pelobatidæ upon which I am able to report in the present communication. The peculiarities therefore cannot be held to be in any way characteristic of sex. In *Leptobrachium hasseltii* (see text-fig. 239) the three posterior petrohyoidei are visible as perfectly distinct muscles. The petrohyoideus posterior primus is in contact with the petrohyoideus anterior. The petrohyoideus posterior secundus is larger than it and the following and last of the muscles, which latter passes under the cartilaginous epiphysis of the thyrohyal bone.

* *Loc. cit.* and fig. *cit.*

† This does not appear to be the case with *Pelodytes*.

‡ According to Göppert's figure, however (*loc. cit.*, fig. *cit.*) the whole of the last petrohyoideus escapes the thyrohyal and is a laryngeal muscle.

§ P. Z. S. 1907, p. 339.

‖ *Loc. cit.* p. 307.

¶ Journ. Linn. Soc., Zool. xxvi. 1897.

The slender petrohyoideus posterior primus seems to be attached to the body of the hyoid just above the articulation of the thyrohyal.

In *Xenophrys monticola* the petrohyoideus posterior primus is separated by a wide gap from the petrohyoideus anterior. The middle and posterior slips of the former are about equal in size; but the latter runs in quite a different direction, passing below the end of the thyrohyal as is shown in the accompanying figure (text-fig. 238, p. 898).

Megalophrys montana is so much like *M. nasuta* (text-fig. 240, p. 902) that a special description is hardly needed. The differences from the last two types will be obvious.

The subhyoideus and the petrohyoidei of *Pelobates fuscus* are different from those of the Oriental Pelobatidæ. Owing to the absence of the anterior cornua of the hyoid in *Megalophrys nasuta*, the subhyoideus is attached to the lateral walls of the skull. In *Pelobates*, on the other hand, as is shown in the figures of Ridewood * and Boulenger †, there is a detached piece of cartilage, in shape like the sound-holes of a violin, on either side which represents the posterior region of the anterior cornu. To the posterior extremity of this is attached the subhyoideus, thus confirming the morphological views held with regard to that piece of cartilage. *Pelobates fuscus* has the usual four pairs of petrohyoideal muscles. Of these the petrohyoideus anterior needs no special comment. The three slips of the petrohyoideus posterior are slender muscles as in *Rana*, and, as is also partly the case in that genus, are all attached to the thyrohyals. And furthermore, again as in *Rana esculenta*, the petrohyoideus posterior tertius is practically entirely inserted upon the end of the thyrohyal. As in *Xenophrys*, the long cartilaginous epiphysis of the thyrohyal—inadequately represented by Boulenger ‡ and Ridewood §—lies between the second and third divisions of the petrohyoideus posterior.

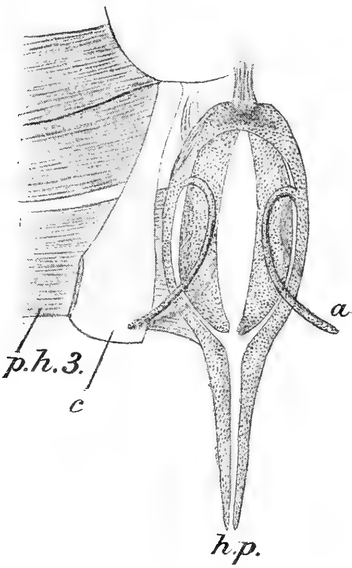
§ *Larynx.*

In my paper upon *Megalophrys nasuta* I did not deal with the larynx of that Frog. I desire therefore in the present place to supplement that deficiency by a few facts. The laryngeal cartilages present us with several differences from those of other Frogs. *Rana* has naturally been taken as the type of the Anuran larynx, and until recently Wiedersheim's ‖ figures of the same. These latter have, however, been shown by H. H. Wilder to be representations of a type "entirely unique" ¶. The more

* P. Z. S. 1897, pl. xxxv. fig. 12.
† Ray Soc. Monograph, p. 197, fig. 75.
‡ *Loc. cit.*, fig. *cit.*
§ *Loc. cit.*, fig. *cit.*
‖ In the various editions of his two text-books.
¶ Zool. Jahrb., Abth. f. Anat. ix. p. 288.

ordinary arrangement is for the bronchial cartilages to be straight bars not fused and contorted to form "a fantastically shaped W." In all of the three types, however, figured by Wilder, the cricoid cartilage or "annulus" is represented as ending medianly in a pharyngeal process closely applied to the ventral wall of the œsophagus. This is termed by Haslam the "spine of cricoid cartilage." It might therefore be inferred that this spine was characteristic of the genus *Rana**. However, this is not the case; for in *Rana tigrina* there is the barest rudiment of this process. Otherwise there are no great differences between that species and "type II" of *Rana* as described by Wilder.

Text-fig. 240.



Laryngeal cartilage and adjacent structure of *Megalophrys nasuta*.

Lettering as in text-fig. 238.

In the figure of the laryngeal cartilages of *Rana esculenta* given in Haslam's translation of Ecker's work †, a stiff membrane is represented as filling up the interspace of the cricoid cartilage. This I find strongly developed in *Rana tigrina*. I mention this point with some emphasis, since in *Megalophrys nasuta* it is represented by an extremely delicate membrane. The two principal features that I have noticed in the structure of the larynx of *Megalophrys nasuta* which differentiate it from that of

* It is very long in *Rana guppyi*.

† P. 313, fig. 204 M.

Rana are the following:—the bronchial cartilages are two very slender cartilages, one on each side. Instead of being stiff, straight, thick processes as in *Rana tigrina*, each is a very slender and arched cartilage, like a bronchial half-hoop, and corresponding of course to the point of opening of the lung into the larynx. I could see no arborescent outgrowths of these such as Ridewood has figured in *Rana* *. Its slenderness and semilunar outline are distinctive as compared with the same cartilage in *Rana*. The second and more striking difference from *Rana* and from other Anura relates to the middle pharyngeal process of the annulus or cricoid cartilage. Instead of being a single median process, this is very distinctly composed of two pieces symmetrical with each other and lying closely side by side, being united by ligamentous tissue. These processes are very long. It seems to be difficult to avoid the conclusion that we have in this Frog a persistent embryonic condition in the separateness of the two halves of the cricoid. This second peculiarity of the larynx of *Megalophrys nasuta* (see text-fig. 240) is not, however, peculiar to that species or genus. I find exactly the same double median pharyngeal process of the cricoid in *Megalophrys montana* and in *Xenophrys monticola*. It would appear therefore to be unlikely that the disposition of these cartilages is in any way related to sex, for the *Xenophrys* which I examined was a male and the two *Megalophrys* were both females. In *Xenophrys monticola* the bronchial cartilage was arched like that of *Megalophrys nasuta*, but shorter and rather stouter.

In *Megalophrys montana* these cartilages are rather more of the type of *Xenophrys* than of *Megalophrys montana*. In all of these Frogs there is an agreement in the position of the point of origin of the bronchial processes in which they all differ from *Rana*. In the latter genus the bronchial cartilages arise from a point not far from being on a level with the posterior end of the thyrohyals. In *Megalophrys* and *Xenophrys*, on the other hand, these processes arise much more anteriorly where the cricoid and arytenoids come into contact to form a hood concealing the anterior end of the aditus laryngis. I have had occasion elsewhere in this paper to refer to differences between *Xenophrys* and *Leptobrachium*, which is interesting in view of their recent fusion to form one genus. I now find that in *Leptobrachium hasseltii* there is at any rate one very well marked difference in the larynx. This difference concerns the cricoid cartilage. These cartilages are not connected posteriorly, in which fact they agree with the other Oriental forms of Pelobatidæ. Moreover, the cartilages are very short and fail by a long distance to meet in the middle line posteriorly, there being of course no pharyngeal process or processes.

* Journ. Linn. Soc., Zool. xxvi. pl. ix. fig. 7.

(4) Definition of the Family Pelobatidæ.

There are not two opinions concerning the validity of the family Pelobatidæ, or respecting the justice of placing in that family all of the genera dealt with in the present communication. Among the matters that require settlement with regard to this family are: the limitations of the several genera which have been assigned to it, their mutual affinities, and the relationship of the Pelobatidæ to other Anurous Batrachia. I pretend to have brought forward in the present communication facts which bear upon the two important questions above set forth. The facts dealt with in the foregoing pages also permit of some extension in the definition of the family. At the present moment the only characters known which combine to define the Pelobatidæ are the following, viz.:—Teeth confined to upper jaw. Vomerine teeth usually present. Omosternum small and cartilaginous, rarely absent *, or larger and calcified †; sternum mostly with an ossified style. Coracoids overlap ("arciferous" shoulder-girdle). Transverse processes of sacral vertebræ large and expanded. Coccyx occasionally fused with sacrum. Tongue round or oval, feebly nicked behind and free (except in *Asterophrys*). Pupil vertical.

These characters are not found collectively in any other family of Anura, though all of them singly or in some slight combination are found in other families. To these characters is sometimes added the condition of the tympanum—stated to be "indistinct." This does not appear to me to be a just character as defining the family. Furthermore, there are a certain number of negative characters, such as—ribs absent, no suckers on fingers and toes, &c.

To these may be now added two rather important characters—whose possible occurrence, however, in other families requires further demonstration. These are the reduction or even absence of the principal cornua of the hyoid complex, in formulating which I confirm and extend the opinion of Boulenger and Ridewood; and the existence of a peculiarly large œsophageal muscle extending in its origin as far back as the middle of the pelvis. The non-union of the two halves of the cricoid and the double character of the often long hypopharyngeal process is characteristic of, though not universal in, this family, and it has not been recorded elsewhere.

The investigations described in the present paper and others referred to allow of the inclusion of a number of other characters, perhaps of minor importance, in the definition of the family Pelobatidæ. So far as we know at present, the thigh-muscles are peculiar in the absence of a deep-seated semitendinosus and the presence of two muscles closely related upon the inner surface of the thigh, which may correspond to the semitendinosus and the

* In *Scaphiopus solitarius*. † In *Megalophrys nasuta*.

sartorius. Another feature is the absence of a superficial sterno-radialis muscle, the existence of a special slip of the rectus abdominis attached to the posterior border of the coracoid, the existence of a strong muscle extending from the ilium to the transverse process of the third vertebra belonging presumably to the ilio-lumbar complex (which is unrepresented in *Rana*, &c.), and the large size of the geniohyoid which covers the hyoglossus. It is possible also that the family will prove to be characterised by the numerous vasa efferentia not forming a rete, and by the absence of a vesicula seminalis.

Finally, the suspension of the right and left lungs up to or nearly to the posterior end by a ligament is, so far as we have gone, a character of this family.

(5) The Genera of Pelobatidæ.

The next point for consideration is the limitation of the several genera treated of in this communication, which are for the most part allowed as valid by systematists. The only genus which is at the moment not generally allowed is *Xenophrys*, which has been included by Boulenger * (whom others follow) in the genus *Leptobrachium*. So far as external characters go, *Megalophrys* might also be included, for *Leptobrachium feæ* and *L. carinense* (occasionally) possess the processes over the eye which has given to *Megalophrys* its generic name.

Mr. W. L. Sclater has also in the paper referred to below † shown that *Leptobrachium carinense* may possess vomerine teeth, which were absent in the first individuals examined by Boulenger but subsequently found by him ‡. This point is a further argument in favour of a coalescence of the genera *Xenophrys* and *Leptobrachium*, which were formerly distinguished by the presence in the former and the absence in the latter of these teeth. Again, the vomerine teeth of *L. carinense* are between or even slightly in front of the choanæ, which tends to throw doubt upon the use of this position of the teeth to distinguish *Megalophrys nasuta* from its congener and from *Xenophrys*. As to other characters, it has been pointed out that *Pelobates cultripes* § varies in the fusion or non-fusion of the sacrum with the coccyx.

It is not, however, reasonable to decline to use as a character an anatomical peculiarity which may happen to vary. Indeed, if this were the case it would be hard to frame a considerable number of apparently useful specific and generic distinctions. In a similar fashion, the procœlous or opisthocœlous nature

* Boulenger, Ann. Mus. Genova, *loc. cit.*

† W. L. Sclater, P. Z. S. 1892, p. 348.

‡ Ann. Mus. Genova (2) xiii. 1893, p. 344.

§ See Boulenger, 'The Tailless Batrachia of Europe,' Ray Soc. 1897, pt. i., and for references to statements made by others upon this anatomical variation which has not apparently been noted in *P. fuscus*.

of the vertebral centra has been shown to vary in one individual of *Xenophrys monticola* by Boulenger, and in other forms by others. If the three characters just shortly dealt with are disallowed as of classificatory value, I do not see how we are to escape from the inclusion in one genus not only of the Oriental, and doubtless closely allied, forms now named *Megalophrys*, *Xenophrys*, and *Leptobrachium*, but also of *Pelobates* and *Pelodytes*. *Scaphiopus* alone (of the genera that are tolerably well known) would escape this simplification in nomenclature. For the internal characters are not very decisive as evidence of generic delimitations. In one or two points, for example, *Xenophrys* stands rather alone, or is much nearer to *Pelobates* than to its more obviously related allies *Megalophrys* and *Leptobrachium*. Elsewhere *Leptobrachium* comes nearer to *Megalophrys nasuta* than to *Xenophrys*. If we were to arrange the different forms considered in the present communication by the mode of suspension of the lungs, *Leptobrachium* and *Megalophrys montana* would be placed together and contrasted with *Megalophrys nasuta* and *Xenophrys*. And other instances of cross-resemblance will be found to occur in the descriptions given in the preceding pages. These differences, however, though apparently unreliable as generic distinctions on account of their—so to speak—capriciousness of occurrence, are, taken in conjunction with the external and osteological characters already known, of sufficient importance in my miud to divide the Pelobatidæ considered in this paper into a number of genera. And I am distinctly of opinion, as far as the facts allow me to judge, that *Xenophrys* must be reinstated and a new genus formed for *Megalophrys nasuta*. On the other hand, it must be borne in mind that these Oriental Pelobatidæ which I distribute among four genera have certain points in common which distinguish them all and equally from *Pelobates*. These points are: (1) the general form of the larynx with its separate cricoids—a persistent embryonic condition as I imagine; (2) the more or less rudimentary condition of the metatarsal tubercle; (3) the less completely webbed hind toes; (4) the presence upon the thighs of a gland-patch; (5) the complete absence of the anterior hyoidean cornua.

Do these outweigh the osteological and other differences which have led to the separation of the Oriental forms into several genera? I am inclined to think not; for they appear to me to be less important even than characters which, if used for that purpose, would relegate *Pelobates* to the same genus as *Xenophrys* or *Pelobatrachus*. This view, however, which is in any case a matter of opinion, may be strengthened or weakened by the future collecting of fact.

The following table indicates the various points of anatomical likeness and unlikeness among the Oriental Pelobatidæ considered in the foregoing pages:—

	Xenophrys.	*Leptobrachium.*	*Megalophrys nasuta.*	*M. montana.*
Metatarsal tubercle.	Elongate.	Small, circular.	Elongate.	Elongate.
Ossifications in skin.	Not recognisable *.	Not recognisable *.	Very strong.	Not recognisable *.
Tympanum	Quite obvious.	Quite obvious.	Absolutely hidden.	Quite obvious.
Vertebræ	Procœlous.	Procœlous.	Procœlous.	Opisthocœlous.
Sacrum	Free from coccyx.	Free from coccyx.	Fused with coccyx.	Free from coccyx.
Anterior processes of hyoid.	Slightly convergent.	Parallel.	Parallel.	Very convergent.
Thyrohyals	Hourglass-shaped.	Rod-like.	Hourglass-shaped.	Hourglass-shaped.
Omosternum	Rudimentary.	Rudimentary.	Fair-sized and calcified.	Rudimentary.
Length of sternum as compared with body.	Long.	Short.	Short.	Long.
Vomerine teeth.	Behind choanæ.	Absent.	Between choanæ.	Behind choanæ.
Liver	Certain differences in form. (See text, p. 880.)			
Lungs	Pulmo-hepatic ligament extending halfway down lung.	Pulmo-hepatic ligament nearly to end of lung.	Pulmo-hepatic ligament halfway down lung.	Attached by pulmo-hepatic ligament for their whole length.
Larynx	Long hypopharyngeal processes.	No hypopharyngeal processes.	Long hypopharyngeal processes.	Long hypopharyngeal processes.
Pectoralis posterior.	Extensive in origin.	Short.	Short.	Short.
Submaxillaris ...	With narrow tendinous median raphe.	With wide tendinous sheet in middle of throat.	As in *Leptobrachium.*	As in *Leptobrachium.*

* *i.e.* to the feel when the frog is handled.

An analysis of this table shows that in the fourteen characters selected, *Xenophrys* is peculiar in only two characters; that it agrees with *Leptobrachium* and *Megalophrys montana* in four points; with *Leptobrachium* alone in no characters, and with *Megalophrys montana* alone in four characters. Of the remaining four characters, *Xenophrys* agrees with *Megalophrys* and *M. montana* in three. *Leptobrachium* is peculiar in four characters; it agrees with *Xenophrys* and *Megalophrys montana* in four characters, and with *Xenophrys* alone in none. With *Megalophrys nasuta*, *Leptobrachium* agrees in two characters. In short, the cross-likenesses and differences between these several types are such that no combination between any two or three of them as against two or one is possible. It shows with peculiar emphasis that *Xenophrys* and *Leptobrachium* are not nearer to each other than any other two. With the addition of some further characters these genera may be described as on the following pages.

The genus *Xenophrys* will be thus characterised :—

Skin with no conspicuous indurations. Aggregations of glands present on thighs. Tympanum fairly conspicuous. Vertebræ procœlous; sacral vertebra free from coccyx. Omosternum rudimentary, cartilaginous; xiphisternum ossified, ending in an expanded cartilaginous plate. Hyoid with anterior processes inclined towards each other; thyrohyals hourglass-shaped with long cartilaginous epiphysis separating the second and third petrohyoidei posteriores. Right lung supported for more than half its length by pulmo-hepatic ligament. Sternum long in proportion to body-length. Pectoralis posterior arising from whole of sternum. Submaxillaris fleshy throughout, with only a fine median tendinous raphe. Subhyoideus not very distinct from submaxillaris and slender. Larynx with long separate hypopharyngeal processes and short bronchial hoop.

The following definition will indicate the chief characters of *Leptobrachium* :—

Skin with no conspicuous indurations. Aggregations of glands present on thighs. Tympanum fairly conspicuous. Vertebræ procœlous; sacral vertebra free from coccyx. Omosternum rudimentary, cartilaginous; xiphisternum ossified, ending in an expanded cartilaginous plate. Hyoid with anterior processes strictly parallel, and not inclined towards each other; thyrohyals rod-like, without a laterally directed epiphysis. Lung supported for nearly its entire length by pulmo-hepatic ligament. Sternum short in proportion to body-length. Pectoralis posterior reduced in size. Submaxillaris with extensive tendinous centre. Subhyoideus very distinct and large. Larynx with no hypopharyngeal processes of cricoids, which remain separate.

Megalophrys has the following characters :—

Skin with no conspicuous indurations; with many tubercles. Aggregations of glands present on thighs. Tympanum fairly conspicuous. Vertebræ opisthocœlous; sacral vertebra free from coccyx. Omosternum rudimentary; xiphisternum ossified, ending in a not expanded cartilaginous plate. Hyoid with anterior processes inclined towards each other; thyrohyals hourglass-shaped with long cartilaginous epiphysis lying behind posterior petrohyoidean muscle. Right lung supported for its entire length by pulmo-hepatic ligament. Sternum long in proportion to body-length. Pectoralis posterior reduced in length of origin. Submaxillaris with extensive tendinous centre. Subhyoideus distinct and large. Larynx as in Xenophrys.

There remains the Frog which I have hitherto referred to under the name of *Megalophrys nasuta*. There is no doubt that if the foregoing genera are allowed, and if *Megalophrys* is distinct from *Leptobrachium*, that that Frog will have to be placed in a distinct genus equivalent to these others. For this genus I suggest the name PELOBATRACHUS, which may be thus defined:—

Skin with conspicuous indurations. A few large tubercles. Aggregations of glands present on thighs, but smaller than in allied genera. Tympanum invisible. Vertebræ procœlous; sacral vertebra fused with coccyx. Omosternum of fair size and calcified in part; sternum ossified with expanded cartilaginous xiphisternum. Hyoid with anterior processes parallel; thyrohyals hourglass-shaped with long cartilaginous epiphysis lying behind last petrohyoid. Right lung supported for half its length by ligament. Sternum short in proportion to body-length. Pectoralis posterior reduced in length. Submaxillaris with extensive tendinous centre. Subhyoideus large and distinct from submaxillaris. Larynx with long separate hypopharyngeal processes and long bronchial hoop on each side.

The following characters are, so far as we know, peculiar or nearly peculiar to, and therefore to be used in the definition of, the genus *Pelobates*:—

Skin without indurations. Vertebræ procœlous. Sacrum fused with coccyx; transverse process of sacrum formed from two vertebræ. Anterior processes of hyoid nearly meeting in middle line; anterior cornua of hyoid rudimentary and detached from the body of the hyoid. No gland on thighs. Toes webbed fully. Metatarsal tubercle a sharp-edged digging-organ. Larynx different in form from that of Oriental Pelobatidæ. Omosternum rudimentary, cartilaginous; xiphisternum ossified, ending in an expanded cartilaginous plate. Sternum short in proportion to body-length. Pectoralis posterior arising from whole of sternum. Submaxillaris fleshy throughout with only a fine tendinous raphe. Subhyoideus not very distinct from submaxillaris.*

The facts do not exist for a criticism of the numerous species that have been described and assigned to the genus *Leptobrachium*, and especially recently. It is clear, however, from these descriptions that external characters formerly regarded as distinctive of the genera *Megalophrys*, *Xenophrys*, and *Leptobrachium* respectively can no longer be allowed. For example, the species *Leptobrachium pelodytoides* † has an oval metatarsal tubercle presumably like that of *Megalophrys*, and therefore not like that of *Leptobrachium hasseltii*. *L. carinense* ‡ has horns on the eyelids as has *Megalophrys*, and the integument is hardened by stellate bony deposits. *L. feæ* has the same characters, and, in addition, warts upon the body, the presence of which differentiated *L. monticola* which has them not, from *Megalophrys* which has them. The fact that these forms possess procœlous vertebræ does indeed

* I reserve details for the present which I hope to furnish later.
† Boulenger, Batrachia in 'Fauna of British India,' 1890, p. 510 &c.
‡ Boulenger, Ann. Mus. Genova, xiii. 1893, p. 344.

differentiate them from *Megalophrys montana*, but not from *Megalophrys nasuta*. *Megalophrys longipes** has a **V**-shaped fold upon the nape which recalls that of *Xenophrys monticola*, and not that of *Megalophrys montana*.

A more satisfactory investigation of these various forms might perhaps break down the distinctions which I have endeavoured to set up between the four Oriental genera, and show that *Asterophrys* and *Batrachopsis* are to be placed with them. In the meantime, however, it is quite clear that the structure of the Pelobatidæ, as far as we know it at present, is quite in harmony with the geographical range of the different forms. There is no doubt that the four genera discussed here, which occur in the Oriental region, are much nearer together on the whole than any one of them is to *Pelobates*, which is Palæarctic in range. It would appear also that the American *Scaphiopus* is quite as widely removed from either group, so far as we can judge from the osteological characters accumulated by Mr. Boulenger †. It is important to have been able to emphasise this relation between structure and geographical distribution.

(6) Affinities of the Pelobatidæ.

A number of features, chiefly to be found in the hyoid and the fused sacral vertebræ, by reason of which the Pelobatidæ resemble the Aglossa, and especially *Pipa*, have been brought together by Dr. Ridewood ‡. I am able in the present communication to add a few points of likeness between these two, at first thought, very dissimilar groups of Anura. It must be remembered, however, that the existing knowledge of the Anura is in so very rudimentary a condition that the following points of likeness between the Pelobatidæ and the Aglossa, though they are, as I hope, accurately stated, may not be confined to the Pelobatidæ; future dissection may show them to apply equally to other families or genera among the Phaneroglossa. In view of the fact that the Aglossa are an especially aquatic race, the members of which rarely leave the water, and are not capable of active progression upon the land, features of structural resemblance between them and the Pelobatidæ in the muscles of the leg are not without interest, for they can be hardly put down to a mere physiological cause. As far as I am aware, the Pelobatidæ are not as a family especially aquatic in their habits.

With regard to the hyoid, I can extend the facts dwelt upon by Dr. Ridewood as evidence of approximation in structure to the Aglossa; for in certain of the Asiatic Pelobatidæ there is the same tendency towards a union of the anterior processes of the body of the hyoid. As an absolutely new point of likeness between the Pelobatidæ and the Aglossa may be pointed out the condition of the most posteriorly lying Petrohyoideus muscle.

* Boulenger, P. Z. S. 1885, p. 850.

† P. Z. S. 1899, p. 792.

‡ Journ. Linn. Soc. xxvi. 1897, p. 111 &c.

This muscle in the Pelobatidæ has retained its embryonic relations to the larynx, and has only in a very slight degree acquired the secondary relation to the thyrohyal. Precisely the same thing is figured by Ridewood for *Xenopus* and *Pipa*. The long extension backwards of the œsophageal muscle, universally characteristic of the Pelobatidæ (as far as our information goes), and its relation to the pelvis is possibly to be compared with the also very largely developed and apparently corresponding muscle in the Aglossa.

5. Microlepidoptera of Tenerife. By the Right Hon. Lord Walsingham, M.A., LL.D., F.R.S., F.Z.S.

[Received November 12, 1907.]

(Plates LI–LIII. and Text-figures 241–243.)

In the Annalen of the K.-k. Naturhistorische Hofmuseum (Vienna) Professor Dr. H. Rebel has published a series of very interesting and instructive papers on the Lepidopterous Fauna of the Canary Islands; I desire now to record the result of a short visit to Tenerife, during which I was able to devote a good deal of attention to the *Microlepidoptera* of the island: a large proportion of these having been bred, it is satisfactory to be able to add some information upon their food-plants and larval habits. In the last of the papers above referred to, published in Vienna in 1906, Prof. Rebel gives a revised systematic catalogue and enumerates 87 species of *Microlepidoptera* (10 of which are merely indicated without special names under the genera to which they belong), 4 out of the remaining 77 not being recorded from Tenerife; we have therefore a residue of 73 species, to which the additions following in this paper may now be made, raising the total to 173 species (of which 70 are here described) distributed among 84 genera (seven of which are new). It is proposed to add some critical notes upon Rebel's List, where these seem to be required through the acquisition of additional information: the species not met with are merely inserted to facilitate reference.

I desire to express my very grateful thanks to Dr. George Perez, and to Dr. O. Burchard, for the great assistance they gave me in naming many plants which I should otherwise have been at a loss to determine; as also to the Rev. A. E. Eaton for numerous additions to my cabinet included in this paper.

I had moreover the great advantage of being allowed to examine Mr. W. W. White's collection at Guimar, enabling me more fully to appreciate the value of Dr. Rebel's work; nor can I forget that that author had already most kindly dealt with some material originally submitted to him from my collection. Without the encouragement offered by the complete and systematic manner in which he undertook and continued his studies I could scarcely yet have ventured to work out my present collection.

In addition to the species named in the following pages a few others may be usefully indicated with a view to their identification by future collectors. I have still a number of living larvae in swelled shoots of *Lycium afrum*, collected at Puerto Orotava on April 27th. They are white with black heads, and were found on two only of several bushes growing along the narrow track leading eastward from the town along the middle of the rocky, abrupt slopes overhanging the sea. They feed in the interior of the base of the long thorn-like shoots which arise from the main branches, at some distance from the stem, causing them to swell perceptibly, but not distorting them. (Writing on September 1st: "None have yet changed to pupae, some have died.")

A larva found at Guimar on April 1st was very long and attenuated, of an ivory-white colour, burrowing along the pith in the interior of a stem of *Salvia canariensis*: this larva was alive a few days ago, but showed no sign of feeding or pupating.

Another larva, which gave me several days of fruitless work, mines the minute leaflets of *Plocama pendula*, hollowing them out, and leaving them white and transparent—a condition in which they rapidly become shrivelled, when all trace of the larval work is lost, except the little brown desiccated point of the leaflets. I found unmistakable traces at Santa Cruz, in January, at the Barranco di Honda, between Santa Cruz and Guimar, in February, and again in a small barranco, close to Guimar, in March, where I secured, at last, one living larva. It was of a very pale amber-yellow, and might have been a *Nepticula*; I failed to rear it.

A larva (possibly a *Phycid*) burrowing under the woolly clothing of the stems of *Phagnalon saxatile* is very abundant at Guimar, and was collected at sundry intervals during my stay there in March and April, producing only repeated disappointment.

During my visit to Tenerife a considerable number of *Macrolepidoptera* were collected which have been placed in the hands of others more competent than myself to deal with them; it may, however, be interesting to mention that I bred a specimen of *Eucrostis simonyi* Rbl. (= *Omphacodes *divincta* Holt-White, *nec* Wkr.), *Geometridae* Stgr-Rbl. I. 2899, from a conspicuous red larva found on *Frankenia ericifolia* on the coast near Guimar, 6. III, excl. 15. IV. 1907.

I. PTEROPHORINA.

Being of opinion that in Entomology "A special type must be a zoological entity in its imaginal form" (Merton Rules, 36), on which text a sermon has yet to be preached, I find myself unable to regard as of generic value embryonic characters unsupported by imaginal differences, and thus obliged to discard no small portion of the generic nomenclature of Vol. V. of Mr. Tutt's 'British Lepidoptera.'

I. PTEROPHORIDAE.

1. (207) BUCKLERIA Tutt.

=**Trichoptilus* Meyr.; Stgr-Rbl. (nec Wlsm.).

I adopt Tutt's geneonym here as I entirely agree with him in separating *paludum* Z. and *siceliota* Z. from the Californian *pygmaeus* Wlsm., the type of *Trichoptilus* Wlsm., which has the fissure of the fore wings differently shaped, the lobes being more divergent.

1. (1311) Buckleria (Stangeia) siceliota Z.

Pterophorus siceliota Z. Isis **1847**. 907 no. 450[1]. *Pterophorus* (*Aciptilia*) *siceliota* Z. Lin. Ent. VI. 401 no. 59 (1852)[2]. *Aciptilia siceliota* Mill. Ann. Soc. Linn. Lyon XXIX. 173–4. Pl. **4** · 3–5 (1882)[3]: Nat. Sic. V. 224 (1886)[4]. *Trichoptilus siceliota* Meyr. Ent. Mo. Mag. XXVI. 12 (1891)[5]; Stgr-Rbl. Cat. Lp. Pal. II. 71 no. 1311 (1901)[6]. *Stangeia siceliota* Tutt Br. Lp. V. 492 (1906)[7].

Hab. S. EUROPE—⊕ *Cistus salviaefolius*, *monspeliensis*, III–IV, excl. V–VI. SW. ASIA. N. AFRICA[5-6]. **Canaries**—Tenerife: Guimar, 14. IV., ⊕ *Cistus monspeliensis*, 28. III, excl. 24. IV – 6. V. 1907.

Taken and bred at Guimar from larvae similar to those which I used to find, and have reared successfully, on the same plant at Cannes.

2. (208) OXYPTILUS Z.

Crombrugghia Tutt Br. Lp. V. 449–51 (1906).

2. (1314) Oxyptilus (Crombrugghia) distans Z.

Pterophorus distans Z. Isis **1847**. 902–3 no. 441[1]. *Pterophorus* (*Oxyptilus*) *distans* Z. Lin. Ent. VI. 345–6 no. 13 (1852)[2]. *Oxyptilus distans* Rbl. Ann. KK. Hofmus. IX. 16, 18 no. 137 (1894)[3]: XXI. 43 no. 173 (1906)[4]: Stgr-Rbl. Cat. Lp. Pal. II. 71 no. 1314 (1901)[5]. *Crombrugghia distans* Tutt Br. Lp. V. 451–67 Pl. **4** · 1–10 (1906)[6].

Hab. S. and C. EUROPE. WC. ASIA. **Canaries**[3-6]—Tenerife: Guimar, 25. III – 14. IV., ⊕ *Andryala pinnatifida*, 9–25. III, excl. 7. IV – 3. V. 1907; Puerto Orotava, 27. IV – 3. V. 1907 (*Wlsm.*); Forest de la Mina, 8. IV. 1894 (*Eaton*); La Laguna, 21. V. 1889 (*Krauss*)[3].

Prof. Rebel [Ann. KK. Hofmus. VII. 262–3 (1892)] records *Oxyptilus laetus* from Tenerife, La Palma, and Gran Canaria; he subsequently [Ann. KK. Hofmus. IX. 81 (1894)] records a single specimen from Tenerife as *O. distans*, suggesting that it may be a spring form of his Canarian *laetus*, and in Staudinger and Rebel's Catalog (II. 1314) he treats *laetus* plus *distans* as two broods under one special name. In his last paper [Ann. KK. Hofmus. XXI. 43 (1906)] he retains both names, possibly through being unable to refer to the single specimen which he had recorded as *laetus*.

I found larvae at Guimar, feeding in March on the crowns of young plants of *Andryala pinnatifida*, completely covering themselves with the woolly débris of the consumed leaves; these produced up to the beginning of May typical forms of *Oxyptilus distans*, which I have compared satisfactorily with the actual types described by Zeller from Syracuse. They are, to all appearance, similar to all that I have previously bred from flowers and leaves of *Andryala sinuata* at Cannes and elsewhere. I have preserved specimens of the larvae for comparison with others from Europe.

Pterophorus laetus Z. Isis **1847**. 903 no. 442[1]. *Pterophorus* (*Oxyptilus*) *laetus* Z. Lin. Ent. VI. 346 no. 11 (1852)[2]. *Oxyptilus laetus* Rbl. Ann. KK. Hofmus. VII. 262–3, 282 no. 36 (1892)[3]: IX. 16, 81 no. 138 (1894)[4]: XXI. 43 no. 174 (1906)[5]. *Oxyptilus distans* Z. (II) *laetus* Stgr-Rbl. Cat. Lp. Pal. II. 71 no. 1314[a] (1901)[6]. *Crombrugghia laetus* Tutt Br. Lp. V. 459–60 (1906)[7].

Hab. S. EUROPE. WC. ASIA. N. AFRICA. **Canaries**[3–7]—La Palma, 25. VIII. 1889 (*Simony*)[3]—Tenerife: Bajomar, 25. V. 1907 (*Wlsm.*); 10. VIII. 1889 (*Simony*)[3]—Gran Canaria: Bco. de los Chorros (San Mateo), 1. VIII. 1890; Mogan, Bco. de los Hornos (Mogan), 4–20. VIII. 1890 (*Simony*)[3].

The only examples apparently agreeing with Zeller's type of *Oxyptilus laetus* were met with at Bajomar, on the sea-coast, where they were easily disturbed from flowering plants of *Andryala pinnatifida*; I brought home only three specimens, some full boxes being lost in my hurry to return to a waiting conveyance. These specimens are uniformly characterised by their slightly smaller size, by the lighter brown, rather than greyish, shade of the forewings, and by the notably bronzy brown tint of the hindwings, not to be found in my series of *distans* from the higher elevations. Tutt (Br. Lp. V. 450–1, 454–9) very strongly contends that there are two distinct species under the above names, and certainly seems to prove his case, but except perhaps by a careful examination of the genital segments, not yet undertaken, I confess to being unable to distinguish them with certainty through an extensive series, bred and captured from many remote localities. It seems indeed quite possible that these Tenerife specimens, obviously attached to the same plant, but at different dates and altitudes, may represent successive broods rather than truly distinct species. I suggest this without in any way disputing Mr. Tutt's conclusions, founded as they are on differences in the genital segments, and on Dr. Chapman's very critical and careful study of the different larvae.

3. (209) PLATYPTILIA Hb.

3. (1339) PLATYPTILIA (AMBLYPTILIA Hb.) ACANTHODACTYLA Hb.

Alucita acanthodactyla Hb. Smlg. Eur. Schm. IX. Pl. **5** · 23–4 (1812 ?) [1]. *Pterophorus acanthodactylus* Stn. Ann-Mag. NH. (3 s.). III. 214 (1859) [2]. *Platyptilia acanthodactyla* Wlsm. Tr. Ent. Soc. Lond. **1894**. 537, 538 no. 1 (1894) [3]. *Amblyptilia acanthodactyla* Rbl. Ann. KK. Hofmus. XI. 115, 146 no. 149 (1896) [4]. *Platyptilia acanthodactyla* Rbl. Ann. KK. Hofmus. XXI. 36, 43 no. 175 (1906) [5]: Stgr-Rbl. Cat. Lp. Pal. II. 73 no. 1339 (1901) [6]; Frnld. Bull. US. Nat. Mus. **52**. 443 no. 4939 (1902) [7]. *Amblyptilia cosmodactyla* Tutt Br. Lp. V. 273–99, Pl. **1** · A [1-6] (1906) [8].

Hab. EUROPE. W. ASIA. N. and S. AFRICA. **Madeiras** [2-4] —MADEIRA [2]: Funchal [3]. **Canaries** [4-8]—TENERIFE: Santa Cruz, 8. II. 1907 (*Wlsm.*), 3. V. 1895 (*Hedemann*) [5]; La Laguna, 8. III. 1904 (*Eaton*), 13. V. 1907 (*Wlsm.*); Guimar, 10. IV. 1907 (*Wlsm.*); Puerto Orotava, 14–22. IV. 1895 (*Hedemann*) [5], 23. IV – 8. V. 1907 (*Wlsm.*)—GRAN CANARIA (*Hedemann*) [5]. UNITED STATES [7].

I must point out that I adopt this name for the Tenerife species in the same sense as it is used by Zeller, and Rebel, and not as referring to *punctidactyla* Hw., being at present unable to agree with Tutt (l. c. 8) in his interpretation of Hübner's figures 23-24, and 35–36 respectively.

4, (210) ALUCITA L.

=*ACIPTILIA* Hb.; *PTEROPHORUS* Meyr. HB. Br. Lp. 435 (1895).

4. (1356·1) ALUCITA BYSTROPOGONIS, sp. n.
(Plate LI. fig. 2.)

Antennae brownish grey. *Palpi* short, slender, porrect; brownish grey. *Head* and *Thorax* brownish grey, the latter becoming hoary grey posteriorly. *Forewings* brownish grey, the fissure extending approximately to half the wing-length; the apical lobe shows two narrow, elongate, smoky blackish cloud-spots on its costal margin, one about the middle of the lobe, the other half-way between this and the base of the fissure; between them the costa is white, and beyond them the lobe is white, with a small black dorsal spot before the apex; the tornal lobe is white, from the base of the fissure to its apex, its costal cilia white on the basal half and smoky black on the distal half of the lobe; the dorsal cilia of the apical lobe whitish beyond the fissure to two-thirds, thence smoky black below the apex; the dorsal cilia of the tornal lobe whitish, with a black spot a little before the middle of the lobe, their tips slightly grey-shaded. *Exp. al.* 16–20 mm. *Hindwings* brownish grey; cilia slightly paler throughout, especially along their base on the dorsum of the tornal lobe. *Abdomen* brownish grey, with slender white lines along either side of the dorsum. *Legs* white, with smoky black patches at the base of each pair of white spurs.

Type ♀ (98768); ♂ (98769); ⊕ (98801) Mus. Wlsm.

Hab. TENERIFE: Forest de la Mina, 7. IV. 1904 (*Eaton*); Guimar, ⊕ *Bystropogon plumosus*, 28. III, excl. 4. IV – 29. V. 1907 (*Wlsm.*); La Laguna, 23. IV. 1907 (*Wlsm.*). Forty-three specimens.

Some varieties assume a decidedly browner tint than the type, and in these the white cilia are often so modified by the extension of the brown suffusion, especially within and below the fissure, as to alter considerably the general appearance of the insect: there are several intermediate degrees of such modification in a bred series.

The larva feeds on *Bystropogon plumosus*, drawing together the leaves and young flower-buds on the leading shoots; it attains a length of 11 mm., and is very pale glaucous green, covered with short and somewhat spatulate hairs, among which longer diverging hairs, arising each from a minute brownish pimple, are ranged in groups along either side of a faint greyish dorsal shade and along the spiracular line; the head is very pale amber-brown. The pupa, which has a line of elongate black spots along the dorsum, is covered with scattered groups of hairs of varying length, the shorter ones not spatulate as in the larva. It is attached posteriorly to the leaf of its food-plant without any encircling band.

I received this insect first from the Rev. A. E. Eaton, taken in the Forest of La Mina, and lately found it abundant above Guimar, but, like its food-plant, it is somewhat local. It reminds one closely of *Gypsochares baptodactyla* Z., and is very similarly coloured, but the lobes of the hindwings are more slender and the fissure of the forewings somewhat deeper. There is a very noticeable difference also in the pupa: that of *Gypsochares baptodactyla* has a line of conspicuous elongate black spots on either side of the dorsum, whereas the pupa of *bystropogonis* has but one mediodorsal line of spots.

5. (1365·1) ALUCITA PARTICILIATA, sp. n.
(Plate LI. fig. 3.)

=**Aciptilia tetradactyla* Rbl. Ann. KK. Hofmus. VII. 263, 280 no. 39 (1892): XXI. 43 no. 177 (1906).

Antennae white, speckled above with brownish grey. *Palpi* porrect, slender; whitish, with a dark spot at the base of the terminal joint, which extends a little beyond an obtuse short frontal tuft. *Head* and *Thorax* brownish ochreous. *Forewings* brownish ochreous at the base, blending to pale straw-whitish beyond; costa narrowly smoky blackish, this colour suffusing the whole of the costal cilia, except about the extreme apex; the fissure extends to a little more than the wing-length; the cilia of the tornal lobe, and of the lower margin of the apical lobe, distinctly straw-white on their basal half and smoky blackish on their outer half (this distinct division in the basal and distal colouring of the cilia is in itself amply and uniformly sufficient to separate *particiliata* from *tetradactyla* L., in which the cilia are darkened throughout). *Exp. al.* 20–22 mm. *Hindwings* brownish ochreous; cilia of all the lobes smoky fuscous on their costal margins, whereas on their dorsal margins the basal two-thirds are straw-white, the distal third only fuscous. *Abdomen* whitish, especially at the base, with a narrow dorsal, and wider lateral brownish grey lines. *Legs* white.

Type ♂ (98810); ♀ (98816) Mus. Wlsm.

Hab. TENERIFE: Santa Cruz, 23. XII – 12. II. 1907; Puerto Orotava, 21. IV. 1907. Fifteen specimens.

Having mistaken this species in the field for *tetradactyla* L., no special search for the larva was undertaken, but I strongly suspect that two green and slightly hairy larvae found on *Lavandula abrotanoides* at Santa Cruz, which I unfortunately failed to rear, must have belonged to it.

Rebel records worn specimens of *Aciptilia tetradactyla* from Pedro Gil (Tenerife, 1600 m., 30. VII. 1889—*Simony*), and from Gran Canaria (*Richter*). As Pedro Gil is on very high ground the date is not surprising, but it is at least probable that these specimens (which I have not seen) belong to the same species which occurs so abundantly at Santa Cruz in January and February, and of which I have a single specimen taken at Puerto Orotava on April 21st. I certainly thought the species was *tetradactyla* when I took it, indeed I should have secured more specimens had I then recognised it as new.

6. (1365·2) ALUCITA HESPERIDELLA, sp. n.

Antennae pale brown, speckled with white. *Palpi* short, porrect, slender, scarcely projecting beyond the face; pale brown. *Head* and *Thorax* pale buff-brown. *Forewings* pale buff-brown, the costa narrowly white, more conspicuously before the apex, a small, oblique, inverted darker greyish streak a little beyond the middle (sometimes obsolete); the fissure extends approximately to half the wing-length, the tornal lobe being white along its upper half from the base of the fissure to its apex, the cilia tinged with brownish grey, as also are those of the apical lobe. *Exp. al.* 16–18 mm. *Hindwings* pale greyish brown; cilia the same, becoming whitish at the apex of the tornal lobe. *Abdomen* pale greyish brown, with whitish dorsal line. *Legs* white, a slender greyish line along their outer sides.

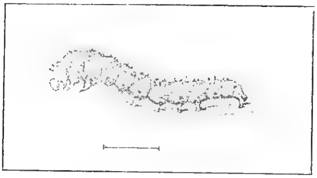
Type ♀ (98825); ♂ (98827); ⊕ (98829) Mus. Wlsm.

Hab. TENERIFE: IV. 1884 (*Leech*); Santa Cruz, 13–31. I. 1907 (*Wlsm.*); Guimar, 21. III. 1904 (*Eaton*), 2. III – 14. IV. 1907, ⊕ *Micromeria varia*, 23. III, excl. 16–26. IV. 1907 (*Wlsm.*); Puerto

Orotava, 27. IV – 8. V. 1907 (*Wlsm.*); La Laguna, 23. V. 1907 (*Wlsm.*); Tacaronte, 31. V. 1907 (*Wlsm.*). Fifty-nine specimens.

Common at Guimar, Santa Cruz, Orotava, etc. The larva is slightly hairy, the hairs arranged in small divergent fascicules; it is of a dull glaucous green, with narrow, parallel, paler dorsal and spiracular lines; head pale brown; it tapers slightly toward the anal segments; all the legs uniformly of the same colour as the body. It feeds on the leaves of *Micromeria varia*, from which it is not difficult to sweep or beat it into the net.

Text-fig. 241.



Alucita hesperidella (98829).

The species greatly resembles *Gypsochares olbiadactyla* Mill., to which it is precisely similar in the distribution of the white margins. Some specimens are distinguishable by the possession of a costal spot, but the uniformly more slender apical lobe of the forewings at once distinguishes it from the more robust *Gypsochares* which in other respects it might almost be said to mimic. Many years ago I received two specimens from the late Mr. J. H. Leech, which stood in my cabinet as doubtfully distinct from *olbiadactyla* until I bred that species.

5 (213) GYPSOCHARES Meyr.

7. (1381) Gypsochares olbiadactyla Mill.

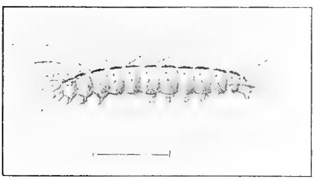
n. syn.=*hedemanni* Rbl.; [=*leptodactyla* Stgr. *LN.*[10]].

Pterophorus olbiadactylus Mill. Ic. Chen-Lp. I. 89–91. Pl. 5 · 1–3 (1859)[1]. *Aciptilia olbiadactyla* Stgr-Wk. Cat. Lp. Eur. 344 no. 3199 (1871)[2]; Mill. Cat. Lp. Alp-Mar. 382–3 (1875)[3]; Hrtm. MT. Münch. Ent. Ver. IV. 68 no. 1399 (1880)[4]; Mill. Nat. Sic. V. 224 no. 3199 (1886)[5]. *Gypsochares hedemanni* Rbl. Ann. KK. Hofmus. XI. 115–6, 146 no. 156, Pl. **3** · 3 (1896)[6]: XXI. 43 no. 178 (1906)[7]: Stgr-Rbl. Cat. Lp. Pal. II. 75 no. 1382 (1901)[8]. *Gypsochares olbiadactyla* Stgr-Rbl. Cat. Lp. Pal. II. 75 no. 1381 (1901)[9]; Wlsm. Ent. Mo. Mag. XXXVII. 234–5 (1901)[10].

Hab. S. France[1–5, 9]—Hyères, ⊕ [*lichen on rocks ?*[1]] 25. III[1–4], excl. IV – V[4]; l'Estérel, 30. IV. 1877[5]: S. Spain[10]: Malaga[10], 28. I., 15–17. IV. 1901 (*Wlsm.*); Chiclana, ⊕ *Phagnalon rupestre*[10], e. II, excl. 27. III – 1. IV. 1901 (*Wlsm.*). **Canaries**—Tenerife: Santa Cruz, ⊕ *Phagnalon saxatile*, 21. I – 3. II, excl. 18. II – 12. IV. 1907 (*Wlsm.*); La Laguna, 23. II. 1904 (*Eaton*); Puerto Orotava, 15–22. IV. 1895 (*Hedemann*)[6], 27. IV. 1907 (*Wlsm.*); Guimar, 2. III – 12. IV. 1907, ⊕, 27. II, excl. 28. IV. 1907 (*Wlsm.*).

Prof. Rebel described his *Gypsochares hedemanni* from specimens collected at Orotava in April; I found the same quite abundant in the larval stage on *Phagnalon saxatile* at Santa Cruz and Guimar, and saw traces of it in other localities where its food-plant occurs. Many years ago Millière gave me a specimen of his *olbiadactylus*, taken in the Estérel (vide Nat. Sic. V. 224): I was therefore well-acquainted with his species, which I have taken in Spain and reared from *Phagnalon rupestre* there. Millière figures and describes the larva and pupa, but he omits to mention whether he actually bred or captured the imago. He suggests that the larvae feed on lichens growing on the rocks where they were found, but he adds that they did not eat in captivity, and quickly pupated. I know that *Phagnalon saxatile* is common in the locality where he discovered the species, and where I have myself searched for it unsuccessfully when in ignorance of its food-plant. His figure of the larva shows no black dorsal spots, nor does he describe them, but the Tenerife larvae (and, if I rightly remember, the Spanish larvae also) possessed a line of such spots, one on each segment. It is open to doubt whether the larvae recorded by Millière on rocks were not those of *Alucita tetradactyla* L., which is abundant on the same spot. After very careful comparison of specimens with Millière's figure, and with the exponent received from him there remains no possible doubt that *Gypsochares hedemanni* as figured and described by Rebel, and represented by a named specimen in Mr. W. W. White's collection, is the same as *Pterophorus olbiadactylus* Mill. I have received the same species from Spain from Dr. Staudinger under the logonym "*leptodactyla*." The traces of the larva are easily recognised by the curling-back of the woolly underside of the leaves from which it has eaten the upper surface and parenchyma, thus exhibiting small white spots distributed about the plants on which it has fed: this is similar to the effect produced by larvae of *Alucita adamas* Cnst., on *Staehelinus*—a noticeable sign of its presence, to which I called my late friend's attention before he was himself acquainted with the larva, and before we had either of us seen the imago.

Text-fig. 242.



Gypsochares olbiadactyla
(98902).

6. (214) PTEROPHORUS Geoffr.

=*ALUCITA* Meyr. HB. Br. Lp. 438 (1895); *EMMELINA* Tutt Br. Lp. V. 97 (1906).

8. (1387) PTEROPHORUS MONODACTYLUS L.

Phalaena Alucita monodactyla L. Syst. Nat. ed. X. 542 no. 300 (1758)[1]. *Pterophorus monodactylus* Alphk. Mem. Lp. V. 231

no. 57 (1889)[2]; Holt White B. & M. Ten. 95 (1894)[3]. *Alucita monodactyla* Wlsm. Tr. Ent. Soc. Lond. **1894**. 537, 539 no. 3[4]. *Pterophorus monodactylus* Rbl. Ann. KK. Hofmus. VII. 263, 282 no. 38 (1892)[5]: IX. 16, 81 no. 140 (1894)[6]: XI. 115, 146 no. 153 (1896)[7]: XXI. 43 no. 179 (1906)[8]; Stgr-Rbl. Cat. Lp. Pal. II. 75 no. 1387 (1901)[9]; Frnld. Bull. US. Nat. Mus. **52**. 446 no. 4981 (1902)[10].

Hab. EUROPE. W. ASIA. N. AFRICA. N. AMERICA. **Madeiras**[1-9]—MADEIRA: (*Wollaston*)[4]. **Canaries**[2-8]—HIERRO: 28. VIII. 1889 (*Speyer*)[5-8]—TENERIFE[2-8]: ⊕ *Convolvulus floridus*[6]; IV. 1884 (*Leech*); Santa Cruz, 28. I. 1907 (*Wlsm.*), 3. V. 1885 (*Hedemann*)[7], 25. V. 1907 (*Wlsm.*); Puerto Orotava, 1887 (*Sievers*)[2]; 3. V. 1907 (*Wlsm.*); Bajomar, 25. V. 1907 (*Wlsm.*)—GRAN CANARIA: Las Palmas, 7. V. 1895 (*Hedemann*)[7-8].

This species occurred everywhere in Tenerife.

9. (1393) PTEROPHORUS (LIOPTILUS Wlgrn.) INULAE Z.

Pterophorus (*Pterophorus* Z.) *inulae* Z. Lin. Ent. VI. 384–6 no. 41 (1852)[1]. *Pterophorus inulae* Stgr-Rbl. Cat. Lp. Pal. II. 76 no. 1393 (1901)[2]. *Leioptilus sp.* Rbl. Ann. KK. Hofmus. IX. 16, 81 no. 141 (1894)[3]: XXI. 43 no. 176 (1906)[4].

Hab. GERMANY. AUSTRIA. **Canaries**—TENERIFE: IV. 1884 (*Leech*); Santa Cruz, ⊕ *Inula viscosa*, 10. I, excl. 24. I – 14. II., 29. IV. 1907 (*Wlsm.*); Guimar, 13. III – 10. IV., ⊕ *Inula viscosa*, III, excl. 23. III – 7. IV. 1907 (*Wlsm.*); Puerto Orotava, 29. IV – 4. V. 1907 (*Wlsm.*); La Laguna, 23. V. 1907 (*Wlsm.*).

Prof. Rebel records an "unbestimbares Fragment" of a species of *Leioptilus* from Guimar, 16. V. 1889 (*Krauss*); this was probably *inulae* Z., which is common and widely distributed in Tenerife. It seems to occur wherever *Inula viscosa* is abundant, as at Guimar, Santa Cruz, Puerto Orotava, etc. I bred specimens from larvae boring the leading shoots; they were easily distinguished by their dull glaucous green colour, and by a conspicuous series of blackish dorsal spots.

10. (1395·1) PTEROPHORUS (LIOPTILUS) MELANOSCHISMA, sp. n. (Plate LI. fig. 1.)

Antennae smoky bone-colour. *Palpi* slender, porrect, projecting less than the length of the head beyond it; smoky fuscous above, pale beneath. *Head* smoky fuscous; face straw-whitish. *Thorax* pale, or sometimes brownish, straw-colour. *Forewings* pale straw, sometimes darker brownish straw—in both cases fading somewhat on the dorsal half; a very narrow fuscous line along the costa to two-thirds from the base; the fissure extends to two-fifths of the wing-length; the cilia within the fissure are uniformly fuscous, connected with a dark fuscous spot at the base of the fissure, which is distinctly visible on the underside; the dorsal cilia are also fuscous. *Exp. al.* 16–17 mm. *Hindwings* and cilia brownish grey, the surface of the lobes somewhat shining. *Abdomen* concolorous with the hindwings. *Legs* straw-white, or straw-brownish, unspotted.

Type ♂ (98934); ♀ (98935) Mus. Wlsm.

Hab. TENERIFE: Santa Cruz, 21. I – 9. II., ⊕ *Phagnalon saxatile*, 31. I, excl. 27–29. III. 1907; Guimar, 12. III. 07; Puerto Orotava, 29. IV. 07. Seven specimens.

The larva feeds in the flowers of *Phagnalon saxatile*, but the species is not abundant. It is closely allied to *pectodactylus* Stgr. (=*chrysocomae* Rgt.), but differs especially in the darkened cilia of the fissure reaching fully to the base; these are very conspicuous.

7. (215) STENOPTILIA Hb.

11. (1406) STENOPTILIA (ADKINIA Tutt) BIPUNCTIDACTYLA Sc.

Phalaena bipunctidactyla Sc. Ent. Carn. 257 no. 673 (1763)[1]. *Pterophorus* (*Pterophorus* Z.) *serotinus* Z. Lin. Ent. VI. 361–4 no. 27 (1852)[2]. *Mimaeseoptilus serotinus* Rbl. Ann. KK. Hofmus. VII. 263, 282 no. 37 (1892)[3]: XXI. 43 no. 180 (1906). *Stenoptilia bipunctidactyla* Stgr-Rbl. Cat. Lp. Pal. II. 76 no. 1406 (1901)[5]. *Adkinia bipunctidactyla* Tutt Br. Lp. V. 97, 334–60 (1906)[6].

Hab. EUROPE. WC. ASIA. N. AFRICA. **Canaries**—TENERIFE[3-6]: 2. VIII. 1889 (*Simony*)[3]; Santa Cruz, 8–16. II. 1907 (*Wlsm.*); Guimar, 14. III – 12. IV. 1907 (*Wlsm.*); Puerto Orotava, 4. V. 1907 (*Wlsm.*); La Laguna, ⊕ *Bartsia trixago*, 12. VI, excl. 1. VII. 1907 (*Wlsm.*).

Common at Santa Cruz, Guimar, and Orotava. Two specimens were bred on July 1st from larvae found feeding on *Bartsia trixago*, at La Laguna, on June 12th. These larvae were noted as pale green, with purplish dorsal line; with groups of hair distributed evenly on each segment, and with minute black tubercular spots above the spiracles: they agreed well with Tutt's description of the larva of *bipunctidactyla* (Br. Lp. V. 350), to which species I have no doubt the Tenerife specimens are rightly referred.

II. AGDISTIDAE.

8. (216) AGDISTIS Hb.

Rebel records only two species, *tamaricis* Z. and *canariensis* Rbl.; I am now able to add *frankeniae* Z., *salsolae* sp. n., and *staticis* Mill.

12. (1420) AGDISTIS FRANKENIAE Z.

Adactyla frankeniae Z. Isis **1847**. 900–2 no. 439[1]. *Agdistis frankeniae* Z. Lin. Ent. VI. 321 no. 1 (1852)[2]; Stgr-Rbl. Cat. Lp. Pal. II. 77 no. 1420 (1901)[3]; Chpm. & Tutt Br. Lp. V. 128–30, 131–2 (1906)[4]; Wlsm. Ent. Rec. XIX. 53–5 (1907)[5].

Hab. S. EUROPE[1-5]—SICILY[1]. CORSICA: Punta Parata, 5. V.

1896 (*Wlsm.*). SPAIN: CADIZ: Chiclana, ⊕ *Frankenia pulverulenta*, 27. I, excl. 2. II. 1901 (*Wlsm.*). N. AFRICA[5]—ALGERIA: Biskra, Hammam-es-Salahin, 5. III – 2. IV. 1903, 14. V. 1903, ⊕ *Frankenia*, 10–22. III, excl. 13. III. 1906, 19. III – 23. IV. 1903 (*Wlsm.*). **Canaries**—TENERIFE: Guimar, 6. III. 1907, ⊕ *Frankenia ericifolia*, 6. III, excl. 6–24. IV. 1907 (*Wlsm.*); Puerto Orotava, 11. III. 1904 (*Eaton*), 21. IV – 14. V. 1907 (*Wlsm.*); Tejina, 18. III. 1902 (*Eaton*); Bajomar, 25. V. 1907 (*Wlsm.*).

This is very common on the coast on *Frankenia ericifolia* and possibly on other species of the genus; the larvae are extremely similar to those of what I must (*pace* Tutt) regard as the very closely allied *Agdistis* (*Ernestia* Tutt) *lerinensis* Mill., but, like the perfect insects, considerably smaller. Although variable in size the Tenerife specimens agree better with Zeller's original types from Sicily than with the uniformly larger specimens which I found at Biskra (Algeria). I took and bred many specimens, including a single example at light at Guimar, 1200 ft. above the sea-level, at which alone its food-plant grows.

13. (1420·1) AGDISTIS SALSOLAE, sp. n.

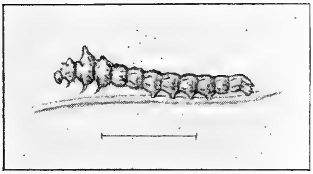
Antennae stone-grey, a dark spot on the basal joint. *Palpi* very short, the median joint rough, hoary grey; terminal joint blackish, not projecting beyond the frontal clothing. *Head* and *Thorax* hoary stone-grey. *Forewings* hoary stone-grey, minutely speckled with black, except on the more thinly clothed, slaty grey, triangular fold-space; the outer third of the costa narrowly white, showing four strong, black, oblique spots, the apex of the wing also black, including the apical cilia; on the lower edge of the fold-space are two strong, elongate, black spots, preceded by a smaller one at the angle of the fold, and followed by another, more conspicuous, and including the cilia at the tornus, before the base of which it is produced upward along the termen; terminal cilia greyish white, a slender blackish line along their middle. *Exp. al.* 16-18 mm. *Hindwings* slaty grey, with some black speckling on their lower half; cilia whitish grey, a slender shade-line along their middle. *Abdomen* brownish grey, with slender white dorsal and lateral lines. *Legs*, posterior pair white, thickly sprinkled with greyish fuscous scales—less thickly on the anterior extremities of the joints.

Type ♂ (98356) Mus. Wlsm.

Hab. TENERIFE: Puerto Orotava, ⊕ *Salsola oppositifolia*, 30. IV – VI, excl. 5. VI – 16. VII. 1907. Six specimens.

The larva is yellowish brown, varying to grey-brown (precisely the colour of dead leaves and stalks of the food-plant); it has a group of four small tubercular excrescences on the prothorax, followed by two much larger and more elevated humps on the mesothorax, each tipped with a black spot; a much shorter pair, also black-tipped, and rather wider apart on the metathorax; on the first abdominal somite are four black dots in two pairs, one behind the other, while on the anterior half of the remaining somites are some more or less strongly indicated slender, blackish, oblique lateral lines; the ninth abdominal somite with two short black protuberances above. Type ⊕ (98418) Mus. Wlsm.

Text-fig. 243.



Agdistis salsolae (98418).

This larva differs in structure from others of the genus, and especially by its much higher metathoracic humps from that of *frankeniae* Z., although in the imago the two species can scarcely be distinguished.

Agdistis salsolae is more easily recognised by a glance at the underside than in any other way, for here *frankeniae* shows only some rather obscure spots on its dull costa, the tornal and apical shades being also insignificant, whereas in *salsolae* the white costa of the forewings shows very clearly on the under side, making the four costal spots very distinct; the apical and tornal patches in the cilia are also very clear, and the limbus of the hindwings is thickly sprinkled with black scales, a raised brush of the same along the cubitus. In *salsolae* the legs are also somewhat stouter and more distinctly mottled, while scarcely any trace is shown of the subcostal spot at the end of the plical space which is always to be found in *frankeniae*; the spots are also usually larger and more conspicuous, but in bred specimens of both species this is scarcely a reliable character.

The larva is extremely difficult to rear, and I was successful with only six out of some sixty collected.

14. (1425) Agdistis canariensis Rbl.

Agdistis canariensis Rbl. Ann. KK. Hofmus. XI. 114–5, 146 no. 148 (1896)[1]: XIII. 380 no. 161 (1899)[2]; XXI. 36, 43 no. 181 (1906)[3]: Stgr-Rbl. Cat. Lp. Pal. II. 78 no. 1425 (1901)[4].

Hab. **Canaries**[1-4] — Tenerife[1-4]: Santa Cruz, 3. V. 1895 (*Hedemann*)[1]; Puerto Orotava, 20. IV – 3. V. 1907 (*Wlsm.*). Fuerteventura[3]: 15. V. 1905 (*Polatzek*)[3].

I have but little to add to what has been already published: a specimen in Mr. White's collection is probably correct, and exhibits the white unspotted costa, beyond the middle of the forewing, specially noted in the original description, and sufficing to separate this from others of the genus. I had at first regarded it as probably a mere variety of some other species, but the distinguishing character is very clearly shown in a specimen (98415) taken at Puerto Orotava, 3. V. 1907, which can only be compared with the nearly allied *adactyla* Hb.

I met with a single small larva (98417) at Guimar, on March 11th, on *Phagnalon saxatile*, the flowers of which it continued to eat very sparingly until it died on May 25th: persistent efforts to find other specimens were unsuccessful. The brownish larva, less than $\frac{1}{4}$ inch in length, has a pair of small projecting pronotal tubercules, and a metanotal pair, larger and more erect, also an anal tubercule; on all the segments are short, reflexed, bristles, arising from pairs of small tubercular excrescences. It differs somewhat from the larva of the allied *satanas* Mill., and I had regarded it as probably that of *adactyla* Hb., with which I am not personally acquainted, until observing the close alliance of the imago of *canariensis* Rbl. to that species. There can be little doubt that this was the larva of *canariensis*, although I so unfortunately failed to rear it.

(1426) AGDISTIS SATANAS Mill.

Agdistis satanas Mill. Bull. Soc. Ent. Fr. XLIV. (5 s. V: **1875**). p. clxvii (1875)[1]; Cat. Lp. Alp-Mar. 377–8. Pl. 2·9 (1875)[2]: Nat. Sic. V. 221–2 no. 3114 bis (1886)[3]: Stgr-Rbl. Cat. Lp. Pal. II. 78 no. 1426 (1901)[4]; Wlsm. Ent. Rec. XIX. 53 (1907)[5].

Hab. S. FRANCE[1-5]: Cannes, ⊕ *Scabiosa candicans* VI, excl. VII[4].

In Mr. Tutt's recently published 'British Lepidoptera' [V. 129, 136 (1906)] some doubt is expressed as to whether a larva which I submitted to Dr. Chapman as that of *Agdistis satanas* Mill. is really an *Agdistis* at all: this opportunity may be taken to record the evidence upon which the identification rests. My experience in attempting to rear *canariensis* was precisely similar to that of Millière, and the failure may probably be attributed to the hibernating habits of the larvae of this group coming into premature practice through the necessity of keeping the bottles containing them in a comparatively cool temperature. I extract the following abridged notes from my voluminous correspondence with my late friend Monsieur Millière:—In 1885 Millière had two larvae which he believed to be those of *Agdistis satanas*. He was taking great care of them—one disappeared, the other fixed itself up for pupation, but did not change, drying up, but preserving its form, so that he could figure it. In his letter to me, of August 19th, 1885, he mentions this fact and adds "car je crois avoir acquis la preuve que c'est bien la chenille de *Satanas*." The proof appears in the following translation: 'One female of this *Agdistis* has had the good thought to lay ten fertile eggs, but I have not been able to feed the little caterpillars, which have not touched anything and have died of hunger. I have preserved in spirit some of these young larvae, which, under a strong lens, seem to me to have all the characters of the caterpillar which you have prepared for your collection. I can send you these larvae obtained *ab ovo*.' I have empty egg-shells, sent at that time, but cannot find the larvae in spirit.

In June 1886 Millière published (Nat. Sic. V. 221–2) the following additional information on *Agdistis satanas*:—

"*Obs.* Au dernier moment je trouve à l'habitat de la *Satanas*, la chenille de cette *Agdistis* qui, du 15 au 25 juin, est parvenue à son entier développement. Elle se nourrit sur la *Scabiosa candicans* dont elle ronge les feuilles, et sans doute sur d'autres plantes sous-ligneuses.

"Cette larve rappelle la chenille de sa congénère *Heydenii*, mais elle est plus courte, avec les caroncules dorsales moins développés et les poils longs et raides, dont elle est couverte, dépourvus, à l'extrémité, du petit renflement spatulifère qu'on remarque chez sa voisine.

"L'état léthargique dure à peine un mois.

"L'*Agd. Satanas* qui n'a qu'une génération pond rarement en captivité, cependent une ♀ enfermée en un tube de verre, ayant pondu une 30e d'œufs, j'ai pu les étudier. Ces œufs sont relativement gros, elliptiques, blanchâtres, et profondement cannelés en long; leur éclosion eut lieu 15 jours après.

"La jeune ch. se montre alors à peu près ce qu'elle sera à ses divers âges. Elle passe l'hiver fixée à une tige sèche, dissimulée dans les brindilles herbacées."

---

15. (1428) Agdistis (Herbertia Tutt) tamaricis Z.

Adactyla tamaricis Z. Isis **1847**. 899 no. 438 · 1 [1]. *Agdistis tamaricis* Z. Lin. Ent. VI. 325–6 no. 7 (1852) [2]; Meyr. Ent. Mo. Mag. XXII. 106 (1885) [3]; B-Bkr. Tr. Ent. Soc. Lond. **1894**. 50 [4]; Rbl. Ann. KK. Hofmus. XI. 115 (1896) [5]: XIII. 376, 380 no. 162 (1898) [6]: XXI. 43 no. 182 (1906) [7]: Stgr-Rbl. Cat. Lp. Pal. II. 78 no. 1428 (1901) [8]. *Herbertia tamaricis* Chpm. & Tutt Br. Lp. V. 129–30, 132, 135, 253 (1906) [9]. *Agdistis tamaricis* Wlsm. Ent. Rec. XIX. 54, 55 (1907) [10].

Hab. S. EUROPE [1-2, 8]. WC. ASIA [8]. AFRICA—Egypt: Alexandria [4]—Algeria [10]: Biskra, Hammam-es-Salahin, 6. III – 28. IV. 1903, 3. IV. 1904, ⊕ *Tamarix*, 9. III, excl. 10. IV. 1904 (*Wlsm.*). **Canaries** [6-8]—Tenerife: Santa Cruz, 30. IV. 1898 (*Hintz*) [6]; ⊕ *Tamarix gallica*, 14. I, excl. 27. II – 8. IV. 1907, ⊕ 24. V, excl. 13–15. VI. 1907 (*Wlsm.*). **Cape de Verdes**: St. Vincent [3, 5-6, 10].

Abundant in many parts of the Island, and no doubt thus widely distributed owing to the prevailing custom of planting *Tamarix* along the sides of the main roads so far as these extend. Preserved larvae compared with European and Algerian specimens show a curious modification in form, the tuberculous excrescences on the prothorax and mesothorax, and on the second, fifth, and ninth abdominal somites, although similarly placed, are distinctly exaggerated, being at least one-third longer than in European specimens, a peculiarity in which they are at least closely approached by larvae from Algeria. I am unable to find any difference in the imago.

16. (1430) Agdistis (Adactylus Crt.) staticis Mill.

Agdistis staticis Mill. Bull. Soc. Ent. Fr. XLIV. (5 s. V: **1875**). p. clxvii (1875) [1]: Cat. Lp. Alp-Mar. 375–6. Pl. **2** · 4–8 (1875) [2]: Wlsm. Ent. Mo. Mag. XXVII. 141 (1891) [3]; Stgr-Rbl. Cat. Lp. Pal. II. 78 no. 1430 (1901) [4]. *Adactylus staticis* Chpm. & Tutt Br. Lp. V. 128–30 (1906) [5]. *Agdistis staticis* Wlsm. Ent. Rec. XIX. 53–4 (1907) [6].

Hab. S. France [1-6]: Ile Ste Marguerite [1-2]; Beaulieu [3]; ⊕ *Statice cordata*, III, excl. 15. V. 1890 [3]; ⊕ V, excl. VIII [1-2]. Algeria [6]: Ain-Oumash [6], Biskra [6], Hammam-es-Salahin [6], ⊕ *Statice limonium* [6], 2. III – 5. IV, excl. 28. IV. 1903, 23. III – 13. VI. 1906 (*Wlsm.*). **Canaries**—Tenerife: Puerto Orotava, ⊕ *Statice pectinata*, 8. V, excl. 29. V – 13. VI. 1907 (*Wlsm.*).

The moths bred at Puerto Orotava from larvae on *Statice pectinata* are of a distinctly darker shade than those from Cannes and Biskra, but perhaps this may be partially due to fading in the older specimens; the larvae are similar.

The larvae of *lerinensis* Mill. could not be found among those of *staticis* as they were at Cannes and Biskra.

II. ORNEODINA.

I. ORNEODIDAE.

9. (217) ORNEODES Ltr.

17. (1438) ORNEODES HÜBNERI Wlgrn.

Alucita hexadactyla Hb. Smlg. Eur. Schm. IX. Pl. **6** · 30–1 (1818)[1]. *Alucita hübneri* Wlgrn. Kngl. Vet-Ak. Hndl. III. (7). 24 (1859)[2]. *Orneodes hübneri* Stgr-Rbl. Cat. Lp. Pal. II. 78 no. 1438 (1901)[3]: Rbl. Ann. KK. Hofmus. XXI. 36, 43 no. 183 (1906)[4].

Hab. EUROPE[1-3]. **Canaries**[4]—TENERIFE: Guimar (*W. W. White*)[4].

Prof. Rebel records *hübneri* from Guimar on the authority of Sir George Hampson. My only knowledge of this species in Tenerife is derived from specimens in Mr. White's collection.

III. TINEINA.

I. GELECHIADAE.

10. (297) METZNERIA Z.

18. (2487·1) METZNERIA INSIGNIFICANS, sp. n.

Antennae snow-white, faintly annulate with greyish fuscous. *Palpi* moderately recurved, the median joint somewhat coarsely scaled, but scarcely roughened beneath; stone-whitish, sprinkled with fawn-brown and greyish fuscous. *Head* and *Thorax* stone-whitish, sprinkled with fawn-brown. *Forewings* stone-whitish, profusely sprinkled with pale fawn-brown and pale greyish fuscous scales; there is a faint indication of a small spot at the end of the cell, preceded by another in the middle of the wing, and the line of the fold is sometimes slightly tinted with ochreous; cilia speckled as on the wing-surface, and with a scarcely perceptible oblique shade-line before their tips. *Exp. al.* 10–11 mm. *Hindwings* iridescent pale bluish grey, with rosy reflections; cilia very pale brownish cinereous. *Abdomen* iridescent, bluish grey. *Legs* pale brownish cinereous.

Type ♂ (14145) Mus. Wlsm.

Hab. TENERIFE: Guimar, 1700 ft., 20. III. 1904 (*Eaton*); Santa Cruz, 3. IV. 1904 (*Eaton*). Two specimens.

I did not meet with this species.

19. (2488·1) METZNERIA INFELIX, sp. n.

Antennae stone-whitish, faintly annulate with greyish fuscous. *Palpi* stone-whitish, shaded with fuscous along their outer sides. *Head* and *Thorax* stone-whitish, sprinkled with fawn-grey. *Forewings* stone-whitish, with a slight ochreous tinge, freely sprinkled with fawn-grey, especially along the costa, along the upper edge of the outer end of the fold, and about the termen; a small fuscous spot in the fold, scarcely before the middle of the wing, is followed by a larger more elongate discal spot, scarcely beyond the middle, another lying at the end of the cell; a few of the scales along the termen are tipped with fuscous, a slight sprinkling also occurring along the middle of the greyish ochreous cilia. *Exp. al.* 11–15 mm. *Hindwings* pale bluish grey; cilia pale greyish ochreous. *Abdomen* fawn-grey; anal tuft stone-whitish. *Legs* stone-whitish.

Type ♂ (98962) Mus. Wlsm.

Hab. TENERIFE: Santa Cruz, 8–14 II. 1907; Puerto Orotava, 23. IV, 10. V. 1907. Five specimens, but only one in good condition.

This species differs from *tristella* Rbl. in having the antennae annulate, and in the paler colour of its somewhat narrow forewings; moreover, although the spots are in the same position they are unaccompanied in this species by the yellowish, or ochreous, streaks which in *tristella* tend to connect and emphasise them. The palpi appear to be also a little more slender.

20. (2489·1) METZNERIA DICHROA, sp. n. (Plate LI. fig. 4.)

Antennae whitish ochreous, speckled with black above. *Palpi* whitish ochreous, more brownish ochreous on their outer sides. *Head* whitish ochreous. *Thorax* pale ochreous. *Forewings* whitish ochreous, longitudinally smeared with pale brownish ochreous below, above, and beyond the cell; an elongate black discal spot lies on the middle of the wing, followed by a smaller one at the end of the cell and preceded by two, even less conspicuous, groups of black scales on the fold and at the upper edge of the cell respectively; cilia whitish ochreous, with a slender brownish line running through their middle. *Exp. al.* 14–16 mm. *Hindwings* tawny grey; cilia pale brownish ochreous. *Abdomen* shining, pale greyish. *Legs* whitish ochreous.

Type ♂ (98304) Mus. Wlsm.

Hab. TENERIFE: Villa Orotava, ⊕ in seed-heads of *Carlina salicifolia*, 25. IV – 7. VII, excl. 3. VI – 18. VII. 1907. Four specimens.

Larva white, without markings. Head olivaceous blackish, rather broadly edged with white on either side of the suture; pronotal plate indistinct, pale olivaceous. Long. 6 mm. *Type* ⊕ (98308: 7. VII.) Mus. Wlsm.

Bred from larvae, collected April 25th, feeding in old seed-heads of *Carlina salicifolia* Cav. in barrancos above Villa Orotova. Allied to *castiliella* Mschl.

21. (2490·1) METZNERIA MONOCHROA, sp. n.
(Plate LI. fig. 5.)

Antennae pale ochreous. *Palpi* ochreous; brownish ochreous on their outer sides. *Head* and *Thorax* pale ochreous, slightly smeared with pale brownish ochreous. *Forewings* whitish ochreous, suffused with very pale brownish ochreous, leaving the neuration faintly indicated by slender lines of the paler ground-colour, scarcely noticeable, except towards the apex; a slight suffusion of fawn-brown from the base of the costa reaches to about one-third, with a group of scales, indicating a spot, below the costa near its termination; a plical spot is placed below and a little beyond this, and there is also a similar fawn-brown spot, rather more conspicuous, at the end of the cell; cilia pale ochreous, with a very faint dividing shade-line. *Exp. al.* 23 mm. *Hindwings* tawny grey; cilia very pale brownish ochreous. *Abdomen* grey. *Legs* pale ochreous; tarsi unspotted.

Type ♂ (98309); ♀ (98310) Mus. Wlsm.

Hab. TENERIFE: La Laguna, 11. V. 1907. Two specimens.

The ♂ in fine condition, the ♀ not quite so good; found below the large leaves of wild Artichoke (*Cynara carduncul us*), sheltering on the ground from a high wind. It is near *torridella* Mn., but much paler and quite distinct.

11, (321) SITOTROGA Hnm.

22. (2902) SITOTROGA CEREALELLA Oliv

Alucita cerealella Oliv. Enc. Méth. IV. (Ins. I.). 121 no. 15 (1789)[1]. *Sitotroga cerealella* Wlsm. Tr. Ent. Soc. Lond. **1894**. 537, 544 no. 32[2]; Rbl. Ann. KK. Hofmus. IX. 18, 89 no. 172 (1894)[3]: XXI. 44 no. 215 (1906)[4]: Stgr-Rbl. Cat. Lp. Pal. II. 157 no. 2902 (1901)[5]; Busck Bull. US. Nat. Mus. **52**. 496 no. 5552 (1902)[6]; Meyr. Pr. Lin. Soc. NSW. XXIX. 286 no. 50 (1904)[7]: Jr. Bomb. NH. Soc. XVI. 591 (1905)[8].

Hab. EUROPE[1-4]. ASIA—CEYLON[8]—JAPAN (*Pryer*: Mus. Wlsm.). AUSTRALIA[7]. N. AMERICA[6]. **Madeiras**[2]—MADEIRA[2]: Funchal (*Wollaston*)[2]. **Canaries**[2-5]—TENERIFE[3-4]: IV. 1884 (*Leech*); Santa Cruz, 31. I. 1907 (*Wlsm.*); Puerto Orotava, 24. III. 1902 (*Eaton*); "on board SS. 'Gando'," 15. VI. 1907 (*Wlsm.*).

Taken at Santa Cruz, and on board ship when coming home.

12. (320·1) PRAGMATODES, gn. n.

(πραγματώδης = troublesome.)

Type *Pragmatodes fruticosella* Wlsm.

Antennae $\frac{4}{5}$, slightly serrate, somewhat thickened in ♂; basal joint without pecten. *Maxillary Palpi* very short, connivent. *Labial Palpi* recurved, moderate, median joint smoothly scaled; terminal joint shorter than median. *Haustellum* moderate. *Head* and *Thorax* smooth. *Forewings* elongate, gradually tapering to apex: *neuration* 12 veins; 7 and 8 stalked, to costa, 6 out of 7; rest separate, 1 furcate at base. *Hindwings* (−1), costa and dorsum almost parallel, apex strongly produced, termen oblique;

cilia 3, costal cilia somewhat bristly towards base: *neuration* 8 veins; 2 to 5 remote; 6 and 7 stalked, 6 weak. *Abdomen* moderate. *Legs*, hind tibiæ clothed with loose hairs.

I am unable to refer this somewhat obscure species to any described genus. In the combined characters 3 and 4 remote, 6 and 7 stalked in the hindwings; and 6 out of 7, beyond its furcation with 8, in the forewings, this agrees with *Sitotroga* Hnm., which however differs in having a pecten on the basal joint of the antennae. *Schistophila* Chrét. and *Glauce* Chmb. differ in having broader hindwings, with 3 somewhat approximated to 4, and the latter has long, flattened, broad, black subcostal bristles. *Ptocheuusa* Hnm. has 3 and 4 of the hindwings connate, and 3 and 4 of the forewings coincident. The group of *Aproaerema* Drnt., having 6 and 7 of the hindwings stalked, differs in having 3 and 4 connate; *Apodia* Hnm. agrees with *Pragmatodes* in the neuration of the forewings, but like other allies of *Aristotelia* Hb., with 3 and 4 of the hindwings remote, differs in having 6 and 7 separate, not stalked.

23. (2901·1) Pragmatodes fruticosella, sp. n.
(Plate LI. fig. 10.)

Poecilia (*Stenolechia*) *sp.* Rbl. Ann. KK. Hofmus. XI. 128, 146 no. 192 (1896)[1]. *Stenolechia* (*Poecilia*) *sp.* Rbl. Ann. KK. Hofmus. XXI. 44 no. 214 (1906)[2].

Antennae dirty whitish, obscurely annulate with fuscous. *Palpi* dirty whitish, dusted with fuscous, a black band before the apex on the median and terminal joints. *Head* and *Thorax* whitish, speckled with fuscous. *Forewings* dirty stone-whitish, dusted with fuscous; a basal patch, with convex outer margin, reaches to nearly one-fifth from the base and is thickly bestrewn with fuscous, the space beyond it forming a narrow fascia of the pale ground-colour, followed by a transverse blackish band, also irregularly convex, but ill-defined on its outer side; this again is followed along the dorsum and costa by somewhat profuse blackish dusting, a small dark discal spot lying in the middle of the wing; beyond the middle an inverted and rather angulated fascia of the pale ground-colour is ill-defined and followed by profuse blackish speckling, reaching to the apex and termen; cilia pale brownish grey, with a shade-line before their outer ends. *Exp. al.* 6·5–7·5 mm. *Hindwings* deeply sinuate, but not squarely excised below the apex; grey; cilia pale brownish grey. *Abdomen* greyish. *Legs* pale brownish grey, with fuscous bands on tibiae and tarsi.

Type ♀ (98969); ♂ (98970) Mus. Wlsm.

Hab. Tenerife: Santa Cruz, 31. I – 21. II, 29. V. 1907, ⊕ *Rubia fruticosa*, 13. II, excl. 19–20. III. 1907; Guimar, 28. II – 4. III. 1907. Ten specimens.

Bred in March from larvae found mining the leaves of *Rubia fruticosa* in February. The moth was also taken on the wing from January to March, and in May, at Santa Cruz and Guimar.

I feel very little doubt that the *Poecilia* (*Stenolechia*) *sp.*, which Rebel described from a worn ♀, taken by von Hedemann, in a barranco near Santa Cruz among *Tamarix*, 5. V. 1895, was the species now described as *fruticosella*, the larvae of which, although difficult to rear, are very common on *Rubia* in all the barrancos west of the town.

13. (320) APODIA Hnm.

24. (2900·4) APODIA GUIMARENSIS, sp. n. (Plate LI. fig. 6.)

Antennae cinereous. *Palpi* whitish cinereous. *Head* and *Thorax* whitish cinereous, the latter with a pale fawn-brown patch above. *Forewings* pale fawn-brown, with whitish cinereous lines and streaks, placed longitudinally and obliquely, but not transversely; one along the costa from base to apex, one along the cell from the base, branching to the costa beyond the middle, and again before the apex; another along the upper edge of the fold as far as the middle of the wing, nearly touching the outer end of an oblique dorsal patch arising before the middle, a similar patch arising before the tornus and angulated outward toward the apex; cilia whitish cinereous, dusted with fawn-brown scales on their basal half. *Exp. al.* 7·5–9 mm. *Hindwings* pale grey; cilia pale brownish cinereous. *Abdomen* brownish grey. *Legs* pale cinereous.

Type ♂ (98979) Mus. Wlsm.

Hab. TENERIFE: Guimar, 13–28. III. 1907 (*Wlsm.*), 20. III. 1904 (*Eaton*). Four specimens.

14. (310) ARISTOTELIA Hb.

25. (2797·1) ARISTOTELIA ANCILLULA, sp. n.

Antennae pale fawn, broadly barred with dark fuscous above, almost obliterating the paler colour, except a noticeable spot at the outer end of the basal joint. *Palpi* pale cinereous; the median joint coarsely clothed beneath, speckled externally with fuscous; terminal joint much sprinkled with fuscous externally. *Head* rosy fawn, shaded with fuscous. *Thorax* rosy fawn, a strong dark fuscous shade anteriorly between the tegulae. *Forewings* rosy fawn, thickly sprinkled with fuscous, and with some dark fuscous, almost black, spots—one on the costa near the base, another, larger, on the dorsum below it, and a smaller one between them—these more or less confluent; opposite the middle spot is a larger one at about one-sixth, its lower edge resting on the fold; again, a little before the middle, is a similar spot on the disc, more or less confluent with a smaller one slightly preceding it on the fold, and these again are followed by a smaller and less conspicuous spot at the end of the cell; cilia rosy fawn, sprinkled with fuscous along their base. *Exp. al.* 13 mm. *Hindwings* (1); shining, somewhat iridescent, pale bluish grey; cilia fawn-brownish. *Abdomen* greyish. *Legs* pale fawn-ochreous, somewhat speckled with pale fuscous.

Type ♀ (98982) Mus. Wlsm.

Hab. TENERIFE: Guimar, 25. III. 1907. Unique.

Agreeing precisely in the form of the hindwing with *servella* Z., but differing from this, and so far as I am aware from all other species of the genus, in the form and distribution of the more or less distinct spots.

26. (2811·1) ARISTOTELIA CACOMICRA, sp. n.

Antennae brownish grey. *Palpi* with the median joint slightly ruffled beneath; pale cinereous, dusted with brownish grey, with a fuscous band around the middle of the terminal point. *Head* and *Thorax* brownish grey. *Forewings* brownish grey, with a slight sprinkling of pale cinereous scales, some of which about the apex are tipped with brownish fuscous; three brownish fuscous spots are indistinctly indicated, one on the middle of the fold, one before the outer end of the fold, and one above and between these, on the cell, forming with them an almost equilateral triangle; cilia brownish cinereous. *Exp. al.* 7–8 mm. *Hindwings* iridescent, dark bluish grey; cilia brownish cinereous. *Abdomen* greyish fuscous. *Legs* brownish cinereous, the tarsi spotted whitish at the joints.

Type ♂ (98983) Mus. Wlsm.

Hab. TENERIFE: Santa Cruz, 26. I – 21. II. 1907, 29. IV. 1907; Puerto Orotava, 14. V. 1907. Seven specimens.

Near *rumicetella* Hfm., but without any indication of pale opposite spots before the apex; also differing noticeably in the absence of the shade-line which runs through the cilia in that species, and gives a rounded appearance to the otherwise almost evenly pointed wing.

15. (319) CHRYSOPORA Clms.

27. (2894·1) CHRYSOPORA BOSEAE, sp. n. (Plate LI. fig. 7.)

Antennae golden yellow, annulate with black. *Palpi* black, medial and terminal joints tipped with yellow. *Head* shining, brassy yellowish. *Thorax* black, with a few yellow scales. *Forewings* black; a bright golden fascia, at one-fourth from the base, descends obliquely inward from costa to dorsum, and is followed on the middle of the dorsum by two yellow spots, the first preceded by some raised black scales and having at its upper edge a tinge of coppery chestnut which is repeated in a strong spot at the end of the cell, above and beyond which is a triangular pale yellow spot on the costa; cilia pale brownish ochreous, thickly sprinkled, except on their outer ends, with black. *Exp. al.* 7–8 mm. *Hindwings* deeply excised below the apex; grey; cilia brownish grey, a slender pale cinereous line marking their base. *Abdomen* blackish. *Legs* black, with pale ochreous spurs; hind tarsi with about five pale ochreous annulations.

Type ♂ (98991); ♀ (98992) Mus. Wlsm.

Hab. TENERIFE: Puerto Orotava, 27. IV – 8. V. 1907, ⊕ mining leaves of *Bosea yervamora*, 21. IV, excl. 11–29. V. 1907. Thirty specimens.

The larva makes blotch-like mines in the leaves of *Bosea yervamora*, an indigenous shrub (which also occurs in the West Indies), on which it is by no means uncommon at Orotava; probably to be found elsewhere, as I believe I recognised the old mines between La Laguna and Tegeste.

16. (311) APROAEREMA Drnt.

=**ANACAMPSIS* Stgr-Rbl. (nec Crt.).

28. (2838) APROAEREMA PSORALELLA Mill.

n. syn. =**albipalpella* (p.) Wlsm. (nec HS.); =*infestella* Rbl.; =**anthyllidella* (p.) Stgr-Rbl.

Gelechia psoralella Mill. Ic. Chen-Lp. II. 83–6. Pl. **61** · 1–6 (1865)[1]: III. 460 (1874)[2]. *Anacampsis psoralella* Stgr-Wk. Cat. Lp. Eur. 299 no. 2079 (1871)[3]; Mill. Cat. Lp. Alp-Mar. 335 (1875)[4]; Hrtm. MT. Münch. Ent. Ver. IV. 24 no. 2079 (1880)[5]. *Anacampsis* **albipalpella* (p.) Wlsm. Tr. Ent. Soc. Lond. **1894**. 537, 544 no. 33 (1894)[6] [*excl.* 'Porto Santo, *Stn.*']. *Anacampsis infestella* Rbl. Ann. KK. Hofmus. XI. 128, 146 no. 195 (1896)[7]: XXI. 44 no. 212 (1906)[8]: Stgr-Rbl. Cat. Lp. Pal. II. 154 no. 2838 (1901)[9]. *Anacampsis* **anthyllidella* (p.) Stgr-Rbl. Cat. Lp. Pal. II. 153 no. 2835 (1901)[10] [*excl.* "Mad."].

Hab. S. FRANCE: Amélie-les-bains; Cannes; Fréjus. ⊕ *Psoralea bituminosa*, X–IV, excl. V–VIII. **Madeiras**[6]—MADEIRA[6]: (*Wollaston*)[6]. **Canaries**[7]—TENERIFE[7]: Guimar, 14. III. 1907, ⊕ *Psoralea bituminosa*, 3–9. IV, excl. 6. IV – 6 V. 1907 (*Wlsm.*); Puerto Orotava, 14–30. IV. 1895 (*Hedemann*)[7]; 26. IV – 14. V. 1907 (*Wlsm.*); Bajomar, 25. V. 1907 (*Wlsm.*).

Stainton [Ann-Mag. NH. (3 s.). III. 213] recorded **anthyllidella* Hb. from Porto Santo (Madeiras), and described *elachistella*, sp. n., from Northern Deserta (Madeiras). In 1894 (l. c. **6**) I referred Stainton's supposed **anthyllidella* to **albipalpella* HS., and recorded as the same species a single specimen (13617) from Madeira. Rebel (l. c. **7**) suggests the possibility that the species recorded by me as **albipalpella* HS. (=**anthyllidella* Stn.) might be the species which he proceeds to describe as *infestella* Rbl. I think this extremely probable, so far as the specimen from Madeira (13617) is concerned, for I have now before me more reliable exponents of *albipalpella* HS., and this Madeiran specimen does not completely agree with them; but it does agree with *psoralella* Mill., which Rebel (l. c. **10**) sinks as a synonym of the true *anthyllidella* Hb. As we are all seeking for the truth, and as one good turn deserves another, may I, in thanking Prof. Rebel for the hint, suggest that his *infestella* is *psoralella* Mill.? In support of this theory, without seeing Rebel's type, I can only say that *psoralella* Mill. is very common on *Psoralea bituminosa* in Tenerife, and the larvae from which I reared it there are the same as those pointed out to me by Millière himself at Cannes many years ago. Rebel's specimens of *infestella* were taken at Orotava 14–30. IV. 1895; I have specimens of *psoralella* labelled Orotava, 26. IV – 14. V. 1907.

In any case I must admit that the Madeira specimen (13617) is *psoralella* Mill., while Stainton's specimen from Porto Santo, recorded as **anthyllidella* (no. XXVIII) has a white face and white palpi, and is a finer specimen of *elachistella* Stn. than is the unset type (no. XXIX, ♂) from Northern Deserta.

28 a. (2846) APROAEREMA ELACHISTELLA Stn.

=**anthyllidella* Stn. (nec Hb.); =**albipalpella* (p.) Wlsm. (nec HS.).
*Gelechia *anthyllidella* Stn. Ann-Mag. NH. (3 s.). III. 213 no. 19 (1859)[1]. *Gelechia elachistella* Stn. Ann-Mag. NH. (3 s.). III. 213 no. 20 (1859)[2]; Wkr. Cat. Lp. BM. XXIX. 628 no. 307 (1864)[3]. *Anacampsis *albipalpella* (p.) Wlsm. Tr. Ent. Soc. Lond. **1894**. 537, 544 no. 33 (1894)[4]. *Anacampsis elachistella* Wlsm. Tr. Ent. Soc. Lond. **1894**. 537, 544 no. 34 (1894)[5]; Stgr-Rbl. Cat. Lp. Pal. II. 154 no. 2846 (1901)[6].

Hab. **Madeiras**[2-6]—NORTHERN DESERTA: (*Wollaston*)[2, 3, 5].—PORTO SANTO: (*Wollaston*)[1]. **Canaries**—GRAN CANARIA: Las Palmas, 15. VI. 1907 (*Wlsm.*).

Stainton [Ann-Mag. NH. (3 s.). III. 213] recorded **anthyllidella* Hb. from Porto Santo, and described *elachistella*, sp. n., from Northern Deserta. In 1894 (l. c. 4) I referred Stainton's supposed **anthyllidella* to **albipalpella* HS., and recorded as the same species a single specimen (13617) from Madeira. Having now before me more reliable exponents of *albipunctella* HS., I find that this specimen from Madeira does not completely agree with them; but it does agree with *psoralella* Mill., which I have bred from *Psoralea bituminosa* at Cannes and in Tenerife. I have again examined Stainton's specimens and find that his **anthyllidella* from Porto Santo (no. XXVIII) has white palpi and white face, and is a finer specimen of *elachistella* Stn. than is the unset type (no. XXIX, ♂) from Northern Deserta. I took two specimens of this species at Las Palmas on June 15th. The locality "*Mad.*" (Stgr-Rbl. Cat. Lp. Pal. II. 153 no. 2835) pertains to *elachistella* Stn. (=**anthyllidella* Stn.)—the true *anthyllidella* Hb. has not yet been recognised as occurring in the Madeiras or Canaries.

29. (2847·01) APROAEREMA GENISTAE, sp. n. (Plate LI. fig. 8.)

Antennae black, with white annulations. *Palpi* white, with a slender black line along the under side of the acute terminal joint. *Head* white. *Thorax* brownish olivaceous. *Forewings* pale brownish olivaceous at the base, blending to blackish about the middle, and on the dorsum nearly to the base; beyond the middle is a straight, well-defined, oblique white fascia, of even width, pointing slightly outward from dorsum to costa; beyond it the terminal portion of the wing is profusely sprinkled with some brownish, many blackish, and a few elongate shining steely grey scales, the latter prevailing around the margin and at the base of the tawny greyish cilia. *Exp. al.* 8 mm. *Hindwings* leaden grey; cilia tawny grey. *Abdomen* leaden grey. *Legs* white, with broad tawny fuscous bands around the hind tibiae.

Type ♀ (98993); ♂ (98994) Mus. Wlsm.

Hab. TENERIFE: La Laguna, ⊕ in shoots of *Genista canariensis*, 18. V, excl. 21. V – 9. VI. 1907. Thirty-three specimens.

Closely allied to *captivella* HS. and *acanthyllidis* Wlsm. [Ent. Mo. Mag. XLI. 40 (1905)], differing from the former in the white fascia being more outwardly oblique from dorsum to costa, and from the latter in the form of this fascia, which is consistently of even width throughout, throwing no projection toward the termen on its outer side; it is also slightly larger and has darker hindwings.

30. (2847·2) APROAEREMA THAUMALEA Wlsm. (Plate LI. fig. 9.)

Aproaerema thaumalea Wlsm. Ent. Mo. Mag. XLI. 41 no. 2847·2 (1905)[1].

Hab. ALGERIA[1]: Hammam-es-Salahin, ⊕ *Astragalus gombo*, III–V, excl. IV–VI.[1] **Canaries**—TENERIFE: Guimar, ⊕ *Lotus sessilifolius*, 6. III, 16–27. IV, excl. 10–29. IV, 20. V. 1907.

Thirteen specimens, bred from larvae forming sand-galleries beneath the trailing shoots of *Lotus sessilifolius*, on the coast near Puerto Guimar, are not in any way distinguishable from my Algerian specimens bred from *Astragalus gombo*. The food-plants are not very nearly allied, but they both grow on hot sandy soil, and the habits of the larvae are almost similar, but the larvae themselves, or at least the specimens which I preserved, believing them to belong to this species, are totally different, so much so that I am led to doubt whether the Algerian specimen (97110) does not rightly belong to some other species feeding on the same plant. About the Tenerife larva there can be no mistake: it is a curious, long, attenuated larva, with the thoracic somites slightly swelled; the head pale yellow-brown, pronotal plate broad, but very faintly indicated; abdominal claspers short almost rudimentary. It is creamy white, with a slender reddish line on either side of the dorsum, running from the mesothorax to the anal extremity. *Long.* 13 mm. ⊕ (98996) Mus. Wlsm. It descends into the sand in a silken tube, coming up to feed on the leaves of the plant, and again retiring below ground. So far as I observed, the Algerian larva did not descend below the surface of the soil, the sand-tubes being among the trailing branches.

The specimen figured (98995, ♀) is from Guimar.

31. (2847·1) APROAEREMA MERCEDELLA, sp. n.
(Plate LI. fig. 11.)

Antennae yellow, annulate with black. *Palpi* pale yellowish, the median joint black nearly to its apex, except a narrow line of white along its upper side; terminal joint with a broad blackish shade before its apex. *Head* yellowish white. *Thorax* pale yellowish, with a diffused greyish fuscous median shade above. *Forewings* blackish, with pale yellowish patches and lines occupying almost as much space as the ground-colour, which is accompanied, around their edges, by some rust-brown suffusion, especially noticeable on the apical portion of the wing; at the extreme base a short yellow streak, which follows the fold, is quickly diverted and dilated to the dorsum; a large pale yellow patch, commencing above its outer extremity on the costa, is attenuated obliquely outward along the cell, ending in a pale ocellate spot at the end of the cell, containing an elongate black dot, a little beyond which an outwardly angulate, narrow, pale yellow fascia crosses the wing; this is produced at either extremity along the margins and around the apex, forming thus a narrow yellowish band enclosing a space of the shape of a blunt arrow-head; cilia pale yellowish, with two parallel black lines running through them and emphasising the obtusely rounded appearance of the apex; the pale costal patch throws a slight excrescence across the fold before the middle, but does not reach the dorsum. *Exp. al.* 10 mm. *Hindwings* leaden grey; cilia brownish grey. *Abdomen* grey; anal tuft ochreous. *Legs* ochreous, the tarsi banded with leaden grey.

Type ♂ (14107) Mus. Wlsm.

Hab. TENERIFE: Las Mercedes, ⊕ on dead moss-grown bark of *Laurocerasus lusitanica*, 7. III, excl. 24. VIII. 1904 (*Eaton*). Unique.

Among described species this is most nearly allied to *nigratomella* Clms. and *concinusella* Chmb., from both of which it differs in the presence of dark dorsal markings; the pattern is found also in other allied American genera. A single specimen was bred by the Rev. A. E. Eaton from a larva found on dead moss-grown bark of *Laurocerasus lusitanica*, 7. III., near the Casa del Agua, in the forest of Las Mercedes, 2050 ft. (near La Laguna), on August 24th, 1904.

17. (303·01) TELPHUSA Chmb.

= *XENOLECHIA* Meyr.

TELPHUSA Chmb. Can. Ent. IV. 132 (1872); Busck Bull. US. Nat. Mus. **52**. 496–7 (1902): Busck Pr. US. Nat. Mus. XXV. 773, 783–9. Pl. **28**·5 (1903).
XENOLECHIA Meyr. HB. Br. Lp. 583 (1895).

32. (2743) TELPHUSA CISTI Stn.

Gelechia cisti Stn. Tin. S-Eur. 211–12 (1869)[1]. *Teleia cisti* Mill. Cat. Lp. Alp-Mar. 331 (1875)[2]; Hrtm. MT. Münch. Ent. Ver. IV. 20 no. 1983 (1880)[3]; Wlsm. Ent. Mo. Mag. XXVII. 145 (1891)[4]; Rbl. Verh. ZB. Ges. Wien XLI. (**1891**). 630 no. 45 (1891)[5]. *Gelechia* (*Teleia*) *cisti* Stgr-Rbl. Cat. Lp. Pal. II. 150 no. 2743 (1901)[6].

Hab. S. EUROPE[1-6]—S. FRANCE[1-6]: ⊕ *Cistus salviaefolius*[1, 3], *C. albidus*[1], III–VI[3], excl. IV–VIII.[3]—DALMATIA[5-6]—CORSICA: Corté, ⊕ *Cistus salviaefolius*, excl. 18–27. VII. 1898 (*Wlsm.*). N. AFRICA—TUNIS; Aine-Draham, 21. VII. 1896 (*Eaton*)—

ALGERIA: Port National, Algiers, 1. XI. 1892 (*Eaton*); Azagga, 2. IX. 1893 (*Eaton*); Lac Houbeira, 3. VII. 1896 (*Eaton*). **Canaries**—TENERIFE: Guimar, ⊕ *Cistus monspeliensis*, 26. II. excl. 4. V – 3. VI. 1907 (*Wlsm.*).

33. (2749·1) TELPHUSA SCHIZOGYNAE, sp. n. (Plate LI. fig. 12.)

Antennae black, dotted with white throughout. *Palpi*, terminal joint longer than the smoothly and compactly clothed median; pinkish white, with two slender black lines running throughout the length of the terminal, and a black patch on the outer side of the median joint at its base. *Head* iridescent, steely whitish. *Thorax* black, shaded with brownish ochreous at the sides. *Forewings* steely whitish, suffused with bluish grey to two-thirds from the base, and again narrowly around the apex; at the extreme base is a short brownish ochreous patch, externally bounded by a black dorsal streak, and separated from the costa by black; there are two black discal spots, one before the middle, one at the end of the cell—the first of these preceded by a similar spot on the fold below it; the outer edge of the blue-grey shading is straight, except for the outer discal spot projecting through it; apex and cilia white, the latter with a faint median shade. *Exp. al.* 14–16 mm. *Hindwings* abruptly and deeply excised below apex, veins 3 and 4 separate, 5 approximate to 4, discoidal weak, 6 and 7 stalked; tawny grey; cilia paler, with a lighter line along their base. *Abdomen* and *Legs* tawny grey, the tarsi pale-spotted.

Type ♂ (98997); ♀ (98998) Mus. Wlsm.

Hab. TENERIFE: Puerto Orotava, ⊕ in galls on stems of *Schizogyne sericea*, 21. IV – 16. V, excl. 25. IV, 10–30. V, 3–30. VI, 2–10. VII, 19. VIII. 1907. Fourteen specimens.

A distinct species, perhaps most resembling *fugitivella* Z. + *lyellella* Crt., but larger. The median joint of the palpi is too smooth to be described as "thickened with rough scales beneath," but the clothing of this joint is variable in the genus *Telphusa*. Bred from larvae feeding in a swelling on the stems of *Schizogyne sericea*: these galls are abundant on the plant, but their numbers are likely to be somewhat misleading as to the abundance of the species, for not only are they for the most part empty galls belonging to many previous seasons, but a very large proportion of the living larvae are affected by parasites—indeed I have been able to rear only fourteen specimens from at least 150 galls collected.

34. (2749·2) TELPHUSA CANARIENSIS, sp. n. (Plate LI. fig. 15.)

Antennae mealy white, annulate with fuscous. *Palpi* mealy white, with two blackish annulations on the terminal joint, and two oblique blackish bars on the outer side of the median. *Head* and *Thorax* mealy white, the latter slightly sprinkled with fuscous. *Forewings* mealy white, sprinkled, and almost suffused locally, with greyish fuscous; an oblique costal spot, at one-sixth from the base, points downward to a similar one on the fold a little beyond it, which again points to another on the dorsum, each containing some raised scales, there is also a small spot at the extreme base of the fold; another costal spot occurs before the middle and is somewhat diffused outward and downward toward a small dark discal spot, beyond which, transversely placed, are two small spots at the end of the cell, these and the preceding being partially surrounded by pale ochreous scaling; there is a faint indication of a transverse shade beyond the end of the cell, throwing an acute angle outward towards the apex from below its middle, the space beyond this shade being of the paler ground-colour, but succeeded by more shady suffusion around the apex and termen; cilia mealy white, dusted with greyish fuscous. *Exp. al.* 16 mm. *Hindwings* pale grey; cilia pale brownish grey. *Abdomen* brownish ochreous. *Legs* whitish ochreous.

Type ♀ (98999) Mus. Wlsm.

Hab. **Canaries**—Tenerife: Guimar, 12. IV. 1907. Unique. Taken at light.

18. (303) GELECHIA Hb.

35. (2533) Gelechia domestica Hw.

35+a. (2533+a) domestica Hw. + domestica Hw.

Recurvaria domestica Hw. Lp. Br. 551 no. 18 (1828)[1]. *Bryotropha domestica* Stgr-Rbl. Cat. Lp. Pal. II. 142 no. 2533 (1901)[2].

Hab. EUROPE—England—Germany—Austria—Italy—Spain. WC. ASIA.

35+b. (2533+b) domestica Hw. + salmonis, var. n.

Bryotropha domestica Wlsm. Tr. Ent. Soc. Lond. **1894**. 537, 544 no. 31 (1894)[1]; Rbl. Ann. KK. Hofmus. XXI. 38, 44 no. 208 (1906)[2].

Hab. Algeria: Hammam-es-Salahin, 18. IV. 1903 (*Wlsm.*); Constantine, 20. V. 1895 (*Eaton*); El-Kantara, 25. V. 1903 (*Wlsm.*). **Madeiras**[1]—Madeira: (*Wollaston*)[1]. **Canaries**[2]—Tenerife: (*White*)[2]; Guimar, 4. IV. 1907 (*Wlsm.*). Five specimens.

Type ♂ (99000) *Guimar*, Mus. Wlsm.

I have already recorded this species from Madeira, and Prof. Rebel mentions a Tenerife specimen which I have seen in Mr. White's collection. I took a fine ♂ at Guimar on April 4th. These specimens have a salmony pink hue in the ground-colour of the forewings, which is wanting in European specimens. I have three specimens, taken in Algeria, which resemble the Canary form, and to which I had given the MS. name "*salmonis*": as all the markings correspond with those of English *domestica* Hw., it is perhaps sufficient to indicate these and the Canary and Madeiran specimens under this varietal name, taking my Guimar ♂ (99000) as the Type of this variety.

36. (2584) GELECHIA PLUTELLIFORMIS Stgr.

=*olbiaella* Mill.; =*siewersiellus* Chr. (nec *sieversi* Stgr., sp. alt., 2584·01).

Gelechia plutelliformis Stgr. Stett. Ent. Ztg. XX. 239 no. 79 (1859)[1]; Stn. Tin. S-Eur. 141, 147 no. 18, 360 (1869)[2]. *Alucita olbiaella* Mill. Ic. Chen-Lp. I. 193–6. Pl. **1** · 1–6 (1861)[3]; Stn. Tin. S-Eur. 167, 182–5 no. 10 (1869)[4]. *Hypsolophus siewersiellus* Chr. Stett. Ent. Ztg. XXVIII. 239–40 (1867)[5]. *Gelechia plutelliformis* Stgr. Berl. Ent. Zts. XIV. 309–10 no. 91 (1870)[6]: Stgr-Wk. Cat. Lp. Eur. 290 no. 1832 (1871)[7]; Mill. Cat. Lp. Alp-Mar. 326 (1875)[8]; Hrtm. MT. Münch. Ent. Ver. IV. 16 no. 1832 (1880)[9]; Curo Cat. Lp. Ital. VI. 38 (1882)[10]; Rouast Cat. Chen. Eur. 155 (1883)[11]; Chr. Mém. Lp. Rmhf. II. 158 no. 316 (1885)[12]; Rbl. Ann. KK. Hofmus. VII. 274, 283 no. 56 (1892)[13]: XIII. 377, 381 no. 203 (1898)[14]: XXI. 44 no. 209 (1906)[15]: Stgr-Rbl. Cat. Lp. Pal. II. 144 no. 2584 (1901)[16].

Hab. S. SPAIN [1–2, 6–7, 10, 13, 16].—S. FRANCE [3–4, 7–8, 10, 13, 16].—SE. RUSSIA: Sarepta [5, 7, 10, 16], 23. V. 1866, 1. VII. 1866, 11. VIII. 870 (*Christoph*). PONTUS [13, 16].—SYRIA [16].—TURA [12, 13, 16]: ⊕ *Tamarix* [1–5, 8–11]: *gallica* [3–4, 8–11]: *laxa* [5, 9]: *pallasii* [5, 9], III–IV [9]; VI–VIII [5, 9]; IX [5]; autumn [3, 4, 11], excl. V [9]–VI [1, 2, 5]; VII [3–4, 5, 8]; VIII [3–4, 8–9]–IX [9]. **Canaries** [13–16]—TENERIFE [13–15]: Guimar, 15. I. 1898 (*Hintz*)[14]; Santa Cruz, 17. I – 2. II. 1907, ⊕ *Tamarix gallica*, XII–I, excl. 20. II – 17. IV. 1907 (*Wlsm.*); Monte de Aguirre, 800 m., 21. VII. 1889 (*Simony*)[13].

Among a series of fifteen specimens, bred from *Tamarix gallica*, near Santa Cruz, one pale variety approaches somewhat closely in colour to the Algerian *sinuatella*, Wlsm. [Ent. Mo. Mag. XL. 223 (1904)], but the form of the markings is distinctly that of *plutelliformis*, which it resembles also in its smaller size.

The larva feeds on *Tamarix gallica*, in December and January, the moth flying in January, February, and March.

Larva, somewhat attenuate to either extremity, greenish yellow, with reddish patches on the anterior portion of each segment, and a few, sparsely distributed, bristly hairs; there is a single black dot on either side of each thoracic somite. Head pale green; no distinguishable pronotal plate; legs and claspers long, blackish.

In 1859 Staudinger described *Gelechia plutelliformis* (Stett. Ent. Ztg. XX. 239) from two ♀♀ bred from larvae taken at Chiclana, and in 1870 he described *Gelechia sieversi* Chr. in litt. (Berl. Ent. Zts. XIV. 309–10), pointing out the differences between the two species, and adopting Christoph's name, apparently overlooking Christoph's description of *Hypsolophus siewersiellus* (Stett. Ent. Ztg. XXVIII. 239–40). The two species are quite distinct and easily separated: in *plutelliformis* the dark streak reaches to the base, and is sinuate thus , being clearly defined beneath by whitish ochreous, but above it fades away into the ground-colour of the wing; at the extremity of the dark sinuate line is a dark extension, sometimes separated from it. In *sieversi* the longitudinal dark marking may be best described as a cuneate streak commencing at half the wing-length and attenuate towards the base, which it does not reach; this streak is sharply edged with whitish above, and slightly beyond its outer extremity, in line with its upper

edge, is an elongate dark streak, also edged above with whitish; at the base is a black limbal streak which does not occur in *plutelliformis*. When describing *siewersiellus*, Christoph had before him (unwittingly) specimens of both *plutelliformis* and *sieversi*, both taken at Sarepta, and apparently both bred from *Tamarix*. His description of *siewersiellus* was obviously taken from *plutelliformis*, and Staudinger und Wocke (Cat. Lp. Eur. 290) give the synonymy correctly thus:
1831. *sieversi* Stgr.
1832. *plutelliformis* Stgr.; =*olbiaëlla* Mill.; =*siewersiellus* Chr.

Christoph's collection contains six specimens and a larva labelled "*sieversi* Stgr."; and four specimens labelled "*plutelliformis* Stgr." These are all from Sarepta, and are correctly determined, except that the third specimen of *plutelliformis* is a worn example of an allied species distinct from both. The name *siewersiellus* does not occur in the collection: the larva labelled "*sieversi*" appears to be distinct from, but closely allied to, that of *plutelliformis* (*siewersiellus*), and probably fed on *Tamarix laxa* or *pallasii* (*vide* Chr. l. c.).

Christoph sent Zeller two specimens, which constitute Zeller's series of "*plutelliformis* Stdg." The first, received from Christoph in 1860, is labelled by Zeller "*Gelechia plutelliformis* Stdg. E. Z. 59, 239": this determination is incorrect, it is *sieversi* Stgr. The second specimen is not specially labelled, not being regarded as distinct from the first; it is, however, truly *plutelliformis* Stgr. (=*siewersiellus* Chr.). When describing *sieversi*, Staudinger observes that, owing to its similarity to *plutelliformis*, he had at first thought it that species, but, recognising its distinctness, he retains for it the name given by Christoph in honour of the now unfortunately deceased entomologist Sievers. It is therefore presumable that Christoph sent Staudinger *sieversi* Stgr., labelled "*siewersiellus* Chr." On the other hand, Christoph sent Hofmann, in 1871, four specimens of "*siewersiella* Chr.", which are rightly determined by Hofmann as *plutelliformis* Stgr.

In Staudinger and Rebel's Catalog (II. 144) we find both species united thus:—
2584. *plutelliformis* Stgr.; = *olbiaëlla* Mill.; = *siewersiellus* Chr.; = *sieversi* Stgr. [ab.].

The confusion caused by both species occurring at Sarepta, and both species being distributed by Christoph as "*siewersiellus*," has doubtless suggested the erroneous idea that the verbal variants *Hypsolophus siewersiellus* Chr. and *Gelechia sieversi* Stgr. pertained to mere varieties of one species. Staudinger's two species are undoubtedly distinct, and we must revert to the synonymy of Staudinger and Wocke's Catalog, correcting that of Staudinger and Rebel thus.—

2584·01. Gelechia sieversi Stgr.

(nec *siewersiellus* Chr., = 2584. *plutelliformis* Stgr.)

Gelechia sieversi Stgr. Berl. Ent. Zts. XIV. 309–10 no. 91 (1870) [1]: Stgr-Wk. Cat Lp. Eur. 290 no. 1831 (1871) [2]; Hrtm. MT. Münch. Ent. Ver. IV. 16 no. 1831 (1880) [3] [* in syn. *plutelliformis* Stgr-Rbl. Cat. Lp. Pal. II. 144 no. 2584 (1901) [4]].

Hab. SE. Russia: Sarepta [1-4], 29. VI. 1859, 16. VI. 1866, 1. VII. 1866, 14. VIII., 18. VIII. 1866, 20. VIII. 1879 (*Christoph*), ⊕ *Tamarix* [1].

37. (2611·2) Gelechia lunariella, sp. n. (Plate LI. fig. 13.)

Antennae shortly biciliate in ♂; blackish, spotted with rosy reddish above. *Palpi* moderately biserrate beneath; rosy whitish, speckled and ringed with black, the terminal joint having a black ring before its middle, and a broader band before its minutely pale apex; the intermediate space pale rosy. *Head* steely greyish, with rosy iridescent scale-tips. *Thorax* black, mixed with rosy reddish. *Forewings* cinereous, varying to rosy reddish; sprinkled and suffused with tawny grey and black scaling, the latter for the most part slightly raised, and exhibited, especially on the base of the dorsum, in an outwardly oblique, narrow, partially interrupted, transverse fascia at about one-sixth from the base; in a patch on the middle of the cell, another, toward the end of the cell, produced downward to the dorsum at the outer end of the fold; above it a blackish costal patch, preceded by an elongate costal shade, the intermediate spaces bright rosy red; the terminal portion of the wing is much mottled with similar colouring, tending to indicate marginal spots, radiating through the tawny greyish cilia, which have two narrow shade-lines running through them before their ends. *Exp. al.* 15–17 mm. *Hindwings* tawny grey, with a rosy tinge; cilia pale brownish cinereous. *Abdomen* and *Legs* brownish cinereous, the latter spotted externally with tawny fuscous.

Type ♂ (99001); ♀ (99002) Mus. Wlsm.

Hab. TENERIFE: San Andres, ⊕ *Rumex lunarius*, 23. I, excl. 27 II – 9. III. 1907; Guimar, ⊕ 12. IV, excl. 11–24. V. 1907; Puerto Orotava, ⊕ 24. IV, excl. 23. V. 1907. Thirteen specimens.

Bred from pale glaucous green larvae collected on *Rumex lunarius* in January and April; these larvae turned to rosy reddish before pupating (99003 Mus. Wlsm.).

I met with this species first at San Andres, near Santa Cruz, and subsequently observed it near Guimar, and again at Orotava. It contorts and attaches together the young terminal leaves of its food-plant, and probably occurs wherever this indigenous shrub is to be found on the island. It is closely allied to *nigrorosea* Wlsm., but is a darker and rather broader winged insect: it is also very near to the European *diffinis* Hw.

38. (2635) GELECHIA EPITHYMELLA Stgr.

Gelechia epithymella Stgr. Stett. Ent. Ztg. XX. 242 no. 89 (1859)[1]; Stn. Tin. S-Eur. 141, 150 no. 28, 332 (1869)[2]. *Lita epithymella* Mill. Ic. Chen-Lp. III. 392–4. Pl. **149** · 8–10 (1874)[3]: Cat. Lp. Alp-Mar. 329 (1875)[4]; Hrtm. MT. Münch. Ent. Ver. IV. 18 no. 1914 (1880)[5]. *Gelechia* (*Lita*) *epithymella* Stgr-Wk. Cat. Lp. Pal. II. 146 no. 2635 (1901)[6].

Hab. S. FRANCE[3-6]: Cannes[3, 4], Monaco[3], Mentone[4], ⊕ *Solanum nigrum*, VIII–IX[3-5], excl. IX–XI[3-5]—S. SPAIN[1-2, 5-6]: Chiclana, 14. III[1-2]. **Canaries**—TENERIFE: Puerto Orotava, ⊕ *Hyoscyamus albus*, 10. V, excl. 6–16. VI. 1907 (*Wlsm.*).

After persistingly searching plants of *Hyoscyamus albus* in the expectation of finding *Gelechia hyoscyamella* Mill., I at last found larvae mining the leaves of two or three plants only, among several, in a lane east of Puerto Orotava. To my surprise these produced rather dark varieties of *Gelechia epithymella* Stgr., which has been recorded as feeding on *Solanum nigrum* in the south of France, but which has not hitherto been observed in Tenerife.

39. (2636·1) GELECHIA MICRADELPHA Wlsm.

Gelechia micradelpha Wlsm. Ent. Mo. Mag. XXXVI. 217–8 no. 1916·3 (1900)[1]; Stgr-Rbl. Cat. Lp. Pal. II. 264 no. 2694[ter] (1901)[2].

Hab. S. FRANCE [1-2]: Perpignan, ⊕ *Lycium europaeum*, 22. V, excl. 7–9. VI. 1899 (*Wlsm.*)[1]. ALGERIA: Biskra, 13. II – 7. IV. 1903, ⊕ *Lycium europaeum*, 12. I, excl. 6. III. 1904 (*Wlsm.*): Hammam-es-Salahin, 22. III – 30. IV. 1904 (*Wlsm.*). **Canaries**—TENERIFE: Santa Cruz, 10. I. 1907 (*Wlsm.*); Puerto Orotava, 27. IV. 1904 (*Wlsm.*).

This obscure little species is common among *Lycium afrum*, west of Santa Cruz, and east of Orotava. It has not hitherto been known to occur in the Canaries, unless it be the same as the worn specimen, taken by von Hedemann at Orotava, 14. IV. 1895, recorded as *Lita sp.*, by Rebel, Ann. KK. Hofmus. XI. 127, 146 no. 191 (1896): XXI. 44 no. 211 (1906).

40. (2712·1) GELECHIA SCIURELLA, sp. n. (Plate LI. fig. 14.)

Antennae dark grey, with blackish annulations. *Palpi* hoary, much sprinkled and suffused with black and chestnut-brown, except on the inner side of the median joint, which appears slightly serrate beneath. *Head* and *Thorax* steely grey. *Forewings* whitish grey, mottled, suffused, and blotched with chestnut-brown and black; the former prevailing especially along the costal area, from the base to beyond the middle, and in a diffused patch a little beyond the upper angle of the cell; the latter especially in a roundish spot on the fold near the base, in a large reniform patch before the middle, its lower edge crossing the fold, and in an inverted, upwardly attenuate, oblique patch resting on the outer end of the fold; the apex and termen are also speckled with black; cilia smoky greyish, with some pale brown around the apex. *Exp. al.* 10–12 mm. *Hindwings* subiridescent, bluish grey; cilia tawny grey. *Abdomen* grey. *Legs* greyish fuscous, pale cinereous at the joints.

Type ♀ (14290) *Funchal* Mus. Wlsm.

Hab. **Madeiras**—MADEIRA: Funchal, 2600 ft., 8. III. 1902 (*Eaton*). **Canaries**—TENERIFE: Guimar, 27. II – 12. IV. 1907 (*Wlsm.*); Arafo, 13. IV. 1907 (*Wlsm.*). Seven specimens.

Most nearly allied to *provinciella* Stn., but smaller and more glossy; the darker shades are greyer, and the ground-colour is more cinereous, less ochreous. I have had the type in my collection for some years: the capture of six worn specimens in Tenerife has induced me to describe it.

19. (300) PLATYEDRA Meyr.

41. (2509) PLATYEDRA VILELLA Z.

Gelechia vilella Z. Isis **1847**. 846–7 no. 393[1]. *Platyedra vilella* Meyr. HB. Br. Lp. 605 (1895)[2]; Stgr-Rbl. Cat. Lp. Pal. II. 141 no. 2509 (1901)[3].

Hab. WC-C. and S. EUROPE—SPAIN: SEVILLA: Corrio del Rio, 10. XII. 1900; Alcalar, 12. XII. 1900 (*Wlsm.*): CADIZ: Jerez de la Frontera, 18. XII. 1900; Chiclana, 22–25. II. 1901

(*Wlsm.*): MALAGA: Malaga, 2. I. 1901 (*Wlsm.*). WC. ASIA. N. AFRICA—MOROCCO: Tangier, 13. IV. 1901 (*Wlsm.*) — ALGERIA: Biskra, 7. III. 1903 (*Wlsm.*). **Canaries**—TENERIFE: Villa Orotava, 19. II. 1907 (*Wlsm.*); near Tacaronte, 29. IV. 1907 (*Wlsm.*).

Two specimens: one taken at Villa Orotava, the other between Villa Orotava and Tacaronte.

20. (300·1) PHTHORIMAEA Meyr.

PHTHORIMAEA Meyr. Ent. Mo. Mag. XXXVIII. 103–4 (1902)[1]; Busck Bull. US. Nat. Mus. **52**. 502 (1902)[2]: Pr. US. Nat. Mus. XXV. 773, 821–3. Pl. **30**· 19 (1903)[3]; Meyr. Pr. Lin. Soc. NSW. XXIX. 259, 315–6 no. 20 (1904)[4].

"*Antennae* $\frac{4}{5}$, in ♂ simple, basal joint elongate, without pecten. *Labial Palpi* long, recurved, second joint expanded with rough projecting scales beneath, terminal joint as long as second, acute. *Forewings*: 2 and 3 parallel, 7 and 8 stalked, 7 to costa. *Hindwings* 1, trapezoidal, apex produced, acute, termen bisinuate, cilia $1\frac{3}{4}$; in ♂ with long pencil of hairs lying along costa from base beneath forewings; 3 and 4 connate, 5 somewhat approximated to 4, 6 and 7 remote, nearly parallel.

"A North American genus of several species, of which one has been artificially introduced with its food-plant into widely separated regions; it is a derivative of *Gnorimoschema* Busck. Imago with forewings elongate, pointed." (*Meyrick*, l. c. 4.)

42. (2509·1) PHTHORIMAEA OPERCULELLA Z.

=§ *terrella* Wkr.; =*solanella* Bdv.; =*tabacella* Rgt.; =*sedata* Btl.; =**piscipellis* Hwrd. (nec Z.).

Gelechia terrella Wkr. Cat. Lp. BM. XXX. 1024 (1864)[1]. *Gelechia* (? *Bryotropha*) *operculella* Z. Verh. ZB. Ges. Wien XXIII: **1873**. Abh. 262–3. Pl. **3**· 17 (1873)[2]. *Bryotropha solanella* Bdv. J. B. Soc. Centr. Hort. (XI. 1874)[3]. *Gelechia tabacella* Rgt. Bull. Soc. Ent. Fr. XLVIII (4 s. IX: **1879**) pp. cxlvi–vii (1880)[4]. *Gelechia sedata* Btl. Cist. Ent. II. 560 no. 88 (1880)[5]. *Litha solanella* Alph. Mém. Lp. Rmhf. V. 231 no. 56 (1889)[6]; Holt White B. & M. Ten. 95 no. 20 (1894)[7]. *Lita solanella* Rbl. Ann. KK. Hofmus. VII. 274–5, 282 no. 57 (1892)[8]: IX. 18, 89 no. 171 (1894)[9]: XI. 127, 146 no. 190 (1896)[10]: XIII. 381 no. 204 (1899)[11]: XXI. 44 no. 210 (1906)[12]. *Gelechia* (*Lita*) *solanella* Stgr-Rbl. Cat. Lp. Pal. II. 146 no. 2636 (1901)[13]. *Phthorimaea operculella* Meyr. Ent. Mo. Mag. XXXVIII. 103–4 (1902)[14]; Busck Bull. US. Nat. Mus. **52**. 502 no. 5616 (1902)[15]: Pr. US. Nat. Mus. XXV. 821–2. Pl. **30**· 19 (1903)[16]; Meyr. Pr. Lin. Soc. NSW. XXIX. 316 no. 94 (1904)[17]; Wlsm. Fn. Hawaii. I. 483–5, 731, 745, 757, 758 no. 21. Pl. **13**· 27 (1907)[18].

Hab. WEST INDIES. UNITED STATES. HAWAIIA. TAHITI. AUSTRALIA. NEW ZEALAND. S. EUROPE—SPAIN. N. AFRICA—ALGERIA. ⊕ mining leaves, shoots, stems, tubers: *Lycopersicum esculentum*; *Nicotiana tabacum*; *Solanum carolinense*, *melongena*, *tuberosum*, I–XII, excl. I–XII. **Canaries**[6-13, 18]—TENERIFE[6-12, 18]: IV. 1885 (*Leech*); Guimar, 2. III – 16. IV. 1907 (*Wlsm.*); La Laguna, 3–23. V. 1907 (*Wlsm.*); Puerto Orotava, IX (*Alpheraky*)[6-8].—FUERTEVENTURA[8-12, 18]: Rio Palma, 20. X. 1890 (*Simony*)[8].

Not uncommon in March and April at Guimar, and at La Laguna in May; often, but not exclusively, near potato-fields.

[For Index to full list of references *vide* Wlsm. l. c. **18.**]

21. (306·01) TRICHOTAPHE Clms.

TRICHOTAPHE Clms. Pr. Ac. Nat. Sc. Phil. XII. 166 (1860)[1]: Clms-Stn. Tin. N. Am. 121 (1872)[2]; Busck Bull. US. Nat. Mus. **52.** 505–7 (1902)[3]: Pr. US. Nat. XXV. 772, 906–16. Pl. **32** · 33 (1903)[4].

"*Antennae* serrate, often more or less ciliated. *Labial Palpi* long, recurved; second joint thickened with scales, appressed and smooth in front and laterally, smooth, or more or less long-haired above (on the inner side); terminal joint long, but shorter than second joint, slender, smooth, pointed. *Forewings* elongate, apex obtuse; 12 veins, 7 and 8 stalked, 2 and 3 stalked. *Hindwings* broader than forewings, slightly sinuate below apex, trapezoidal, anal angle rounded; 8 veins, 3 and 4 connate with a tendency to become short-stalked, 5 approximate to 4, 6 and 7 connate with a tendency to become short-stalked. Discal vein in several species with a tendency to become obsolete." (*Busck*, l. c. **3.**)

43. (2270·01) TRICHOTAPHE LAMPROSTOMA Z.

=*zulu* Wlsm.

Gelechia lamprostoma Z. Isis. **1847.** 851–2 no. 400[1]. *Gelechia zulu* Wlsm. Tr. Ent. Soc. Lond. **1881.** 261–2. Pl. **12** · 30[2]. *Anacampsis lamprostoma* Stgr-Rbl. Cat. Lp. Pal. II. 154 no. 2848 (1901)[3]. *Aproaerema lamprostoma* Wlsm. Ent. Mo. Mag. XXXVII. 236 (1901)[4]. *Onebala lamprostoma* Wlsm. Ent. Mo. Mag. XL. 267–8 no. 2770·1 (1904)[5]. *Anacampsis* (*Onebala*) *lamprostoma* Rbl. Ann. KK. Hofmus. XXI. 38, 44 no. 213 (1906)[6].

Hab. SW. ASIA[3, 5]: VI[5]. S. EUROPE[1, 3, 5]—SICILY, V[1, 3, 5]—SPAIN, V[3-5]. AFRICA—ALGERIA: IV[5]—GAMBIA: XI[5].—NATAL: VII; XII[4]. **Canaries**—TENERIFE[6]: (*White*, 1905)[6]: Puerto Orotava, 10. V. 1907, ⊕ *Convolvulus althaeoides*, 10. V, excl. 15. VI. 1907 (*Wlsm.*).

I bred a single specimen from a larva found at Puerto Orotava; this did not emerge until June 5th, although I captured five specimens on the same spot on May 10th, when I found the larva feeding on *Convolvulus althaeoides*: the food-plant of this species was hitherto unknown.

44. (2270·02) TRICHOTAPHE CONVOLVULI, sp. n.
(Plate LI. fig. 16.)

= *Ceratophora sp.* Rbl. Ann. KK. Hofmus. VII. 275, 283 no. 58 (1892)[1]. *Brachmia* (*Ceratophora*) *sp.* Rbl. Ann. KK. Hofmus. XXI. 44 no. 216 (1906)[2].

Antennae dark tawny fuscous. *Palpi* dull whitish ochreous, unspotted; the median joint clothed with closely appressed scales. *Head* whitish ochreous. *Thorax* dark tawny fuscous. *Forewings* dark tawny fuscous, with a small, narrow, elongate, pale ochreous costal spot at four-fifths from the base; on the cell, at one-third from the base, is an elongate blackish spot, followed by another at two-thirds—each rather obscurely annulate with chestnut-brown scales; a similar spot lies in the fold, straight below the first discal, and a row of minute ochreous spots precedes the dark tawny grey cilia. *Exp. al.* 13–15 mm. *Hindwings* brownish grey, with a slender pale ochreous line along the base of the otherwise unicolorous cilia. *Abdomen* fuscous. *Legs* dark tawny fuscous; the spurs and joints of the tarsi pale cinereous.

This species (which is obviously the same as *Ceratophora sp.* Rbl.) is closely allied to *juncidella* Clms., but differs in its darker face and palpi: the median joint of the palpi is more roughly scaled, and the pale costal spot is distinctly visible on the under side of the forewings.

Type ♀ (99004); ♂ (99005); ⊕ (99006) Mus. Wlsm.

Hab. **Canaries**—TENERIFE: Santa Cruz, 19–22. I. 1907, ⊕ *Ipomoea quinquefolia*, 19. I, excl. 20. II – 2. III. 1907 (*Wlsm.*). —GRAN CANARIA: (*Richter*)[1–2]. Thirty-two specimens.

Bred from larvae reminding one much of those of *Brachmia rufescens* Hw. in their black and white oblique striping. Head honey-yellowish, edged with blackish; pronotal plate honey-yellow, posteriorly broadly black-margined lunately, suture honey-yellow; mesothorax, metathorax, and abdominal somites I–II blackish, mesothorax conspicuously separated by white from the metathorax and prothorax, the latter similarly separated from the head; abdominal somites III–IX white, with blackish markings—the lateral markings are oblique, as in *rufescens*, but having no pale dorsal stripe to interrupt them, anteriorly above, they form on each segment a complete arcuate band, followed on somites III–VII by a transverse bar of the same colour, but on V this bar is not apparent, owing to dark dorsal suffusion; normal spots distinct, black; legs black, abdominal claspers tipped with blackish; *long.* 15 mm. (99006 Mus. Wlsm.). The larvae roll the leaves of *Ipomoea quinquefolia* in January, and are extremely abundant on this introduced plant at Santa Cruz, especially on a wall below the Quisisana Hotel.

22. (349·1) APATEMA Wlsm.

APATEMA Wlsm. Ent. Mo. Mag. XXXVI. 219–20 (1900); Stgr-Rbl. Cat. Lp. Pal. II. 265 no. 348bis (1901).

45. (3050·1) APATEMA FASCIATUM Stn.

n. synn. =**quadripuncta* Stn. (*nec* Hw.); =*coarctella* Rbl.; =*mediopallidum* Wlsm.

Gelechia fasciata Stn. Ann-Mag. NH. (3 s.). III. 213 no. 18 (1859)[1]; Wkr. Cat. Lp. BM. XXIX. 628 (1864)[2]. **Oegoconia* **quadripuncta* Stn. Tin. Syr. As-Min. 41 no. 23 (1867)[3]. *Hypatima fasciata* Wlsm. Tr. Ent. Soc. Lond. **1894.** 538, 554 no. 56 (1894)[4]. *Lampros coarctella* Rbl. Ann. KK. Hofmus. XI. 129–30, 147 no. 198, Pl. 3 · 11 (1896)[5]. *Apatema mediopallidum* Wlsm. Ent. Mo. Mag. XXXVI. 220 no. 2223 · 1 (1900)[6]; Stgr-Rbl. Cat. Lp. Pal. II. 265 no. 3049bis (1901)[7]. *Hypatima fasciata* Stgr-Rbl. Cat. Lp. Pal. II. 164 no. 3073 (1901)[8]. *Borkhausenia coarctella* Stgr-Rbl. Cat. Lp. Pal. II. 178 no. 3380 (1901)[9]: Rbl. Ann. KK. Hofmus. XXI. 44 no. 229 (1906)[10].

Hab. WC. ASIA—PALESTINE[1]: Plains of Jordan, 1865 (*O. P. Cambridge*)[1]. S. EUROPE—CORSICA[6-7]: Ajaccio, 6. V. 1896 (*Wlsm.*)[6]; Ile Rousse, 5. VI. 1898 (*Wlsm.*)[6]—S. SPAIN: GRANADA: Granada, 13–17. VI. 1901 (*Wlsm.*)—GIBRALTAR: 3. VI. 1903 (*Wlsm.*). N. AFRICA—MOROCCO: Tangier, 14. IV – 18. V. 1902 (*Wlsm.*)—ALGERIA: Biskra, 9. IV. 1903 (*Wlsm.*). **Madeiras**[1-2, 4-5, 8] —MADEIRA[4-5]: Funchal[4], The Mount (*Wollaston*)[4]—DESERTA GRANDE[1, 4]: (*Wollaston*)[1, 4]. **Canaries**[5, 9-10]—TENERIFE[5, 10]: Santa Cruz, 2. I – 20. II. 1907 (*Wlsm.*); Guimar, 20. III. 1904 (*Eaton*), 9. III – 18. IV. 1907 (*Wlsm.*); La Laguna, 27. III. 1904 (*Eaton*), 23. V. 1907 (*Wlsm.*); Puerto Orotava, 26–30. IV. 1895 (*Hedemann*)[5], 21. IV – 2. V. 1907 (*Wlsm.*).—GRAN CANARIA[5, 10]: Las Palmas, 9. V. 1895 (*Hedemann*)[5].

Having placed this species in the *Oecophoridae*, through failing to observe that veins 6 and 7 of the hindwings were stalked, Prof. Rebel not unnaturally overlooked my genus *Apatema* (*Gelechiadae*, 1900), allied to *Oecogenia* (**Oegoconia*) Stn., and *Symmoca* Hb.; and when describing *mediopallidum*, from Corsica, I overlooked the Madeiran *Gelechia fasciata* Stn., which I had erroneously referred to *Hypatima* Stgr-Wk. (nec Hb.) in 1894. The specimen which Stainton recorded as *Oegoconia quadripuncta* Hw., from the Jordan (9212 Mus. Wlsm.), is *Apatema fasciata* Stn., badly worn.

[It should be observed that HYPATOPA Wlsm. Pr. US. Nat. Mus. XXXIII. 200, 211 (1907)=**Hypatima* HS. (nec Hb.) type *Oecophora inunctella* Z., and that HYPATIMA Hb. (nec HS.)= *Chelaria* Hw.]

46. (3050·2) APATEMA LUCIDUM, sp. n. (Plate LII. fig. 3.)

Antennae greyish ochreous; basal joint black above. *Palpi* pale ochreous, the median joint shaded on its basal half with black, and with a black spot on its distal half externally. *Head* and *Thorax* pale ochreous, the latter slightly shaded with fawn-brown anteriorly. *Forewings* pale ochreous, partially shaded with umber-brown, especially below the fold, on the outer half of the costa, and around the apex where the dark scales project more or less through the pale ochreous cilia; the extreme base of the costa is narrowly black, a few black scales being scattered along the base of the dorsum; at one-third from the base are two small black spots placed obliquely in the cell, sometimes confluent, and beneath the outer one is a stronger black spot in the fold; beyond these, at the end of the cell and preceded by a small elongate spot at its upper edge, is an oblique reniform patch, covering the discoidal and produced inward from the upper angle —these markings are subject to more or less modification, and are less distinct in some specimens than in others, but their position is uniformly maintained. *Exp. al.* 13–14 mm. *Hindwings* pale straw-whitish; cilia pale ochreous. *Abdomen* and *Legs* pale ochreous, the tibiae and tarsi slightly shaded with brownish on their outer sides.

Type ♂ (98242); ♀ (98241) Mus. Wlsm.

Hab. TENERIFE: Forest de la Mina, 7. IV. 1904 (*Eaton*); Realejo, 7. V. 1907 (*Wlsm.*); Las Mercedes, 19. V. 1907 (*Wlsm.*); La Laguna, 23. V. 1907 (*Wlsm.*); Tacaronte, 31. V. 1907 (*Wlsm.*). Thirteen specimens.

This species is somewhat larger on the average than *Apatema fasciatum*, and the forewings are uniformly broader; their invariably ochraceous ground-colour and the distribution of the black spots, with the absence of any distinct shade across the base, serve to distinguish it from its ally—like the forewings the hindwings are also of an entirely different hue. It does not appear to be a common species.

23. (349·2) AMBLOMA, gn. n.

(ἄμβλωμα = abortion.)

Type *Ambloma brachyptera* Wlsm.

Antennae without pecten; a little longer than the forewings; simple in ♂. *Maxillary Palpi* short. *Labial Palpi* bent upwards, reaching to vertex; median joint moderately clothed with slightly projecting scales below at apex; terminal joint short, smooth. *Head* and *Thorax* smooth. *Forewings* very short, tapering rapidly to a slightly depressed, obtusely pointed apex; costa evenly convex, flexus rather squarely developed, dorsum straight beyond the flexus: *neuration* 12 veins; 7 and 8 stalked, to costa; 6 out of stalk of (7+8); cell short. *Hindwings* $\frac{2}{3}$, much shorter, but of the same shape as the forewings; cilia $1\frac{1}{2}$: *neuration* 8 veins; 6 and 7 stalked; 3 and 4 stalked. *Abdomen* smooth. *Legs*, hind tibiae moderately hairy.

Allied to *Apatema* Wlsm. and *Symmoca* Hb., but differing in its curiously aborted appearance, which recalls the form of *Embryonopsis* Etn. and *Hodegia* Wlsm., both insular forms, and, in the European fauna, the ♀ of *Chimabacche* Hb.

47. (3050·3) AMBLOMA BRACHYPTERA, sp. n.
(Plate LI. fig. 18.)

Antennae dark greyish fuscous, the basal joint hoary white. *Palpi* greyish fuscous externally, hoary white on their inner sides, and around the apex of the median joint. *Head* and *Thorax* hoary white, the latter with grey sprinkling. *Forewings* hoary white, profusely sprinkled with dark stone-grey scales, but devoid of pattern; a slight spot of ochreous suffusion on the cell a little before the middle of the wing; cilia hoary whitish, with a slight admixture of grey, especially about the tornus. *Exp. al.* 9 mm. *Hindwings* whitish grey; cilia pale grey. *Abdomen* ochreous; anal tuft hoary white. *Legs* whitish, dusted with brownish grey, the tarsi faintly banded.

Type ♂ (99007) Mus. Wlsm.

Hab. TENERIFE: Guimar, 6. III. 1907. Unique.

Found under leaves of *Lotus sessilifolius*, on the black sand of the coast near Puerto Guimar. No other specimen seen.

24. (348·01) CHERSOGENES, gn. n.
(χερσογενής = bred on dry land.)

Type *Chersogenes victimella* Wlsm.

Antennae 1, simple in ♂; without pecten. *Maxillary Palpi* moderate. *Labial Palpi* extending fully three times the length of the head beyond it; median joint thickly clothed above and beneath, the lower scales projecting nearly half the length of the slender, erect terminal joint, beyond its base. *Haustellum* moderate. *Head* and *Thorax* moderately smooth. *Forewings* narrow, elongate, lanceolate, with straightened costa and slightly curved dorsum tapering to a point: *neuration* 12 veins; 7 and 8 stalked, 7 to termen; rest separate. *Hindwings* as broad as the forewings, considerably shorter, but much the same shape; cilia $1\frac{1}{2}$: *neuration* 8 veins; 6 and 7 long-stalked; 3 and 4 long-stalked. *Abdomen* smooth, somewhat flattened; uncus and claspers strongly developed. *Legs*, hind tibiae slightly hairy.

This genus is most nearly allied to *Epanastasis* Wlsm., but differs in the structure of the palpi.

48. (3022·01) CHERSOGENES VICTIMELLA, sp. n.
(Plate LI. fig. 17.)

Antennae dark brownish fuscous. *Palpi* hoary whitish, sprinkled with fuscous scales on their outer sides. *Head* and *Thorax* cinereous, dusted with fuscous. *Forewings* pale cinereous, densely sprinkled with fuscous throughout, except along a narrow line running from the base to the lower angle of the cell, with a slight break about its middle; on either side of this break is a small spot of raised dark fuscous scales, two similar spots appearing on either side of the outer end of the pale line, the lower spot in each case being a little further from the base than the one above it; there is also an indication of a small group of dark fuscous scales resting on the upper edge of the cell at its base; cilia cinereous, sprinkled with fuscous. *Exp. al.* 12 mm. *Hindwings* and cilia dark tawny brown. *Abdomen* brownish cinereous. *Legs* pale cinereous, slightly dusted with fuscous.

Type ♂ (99008) Mus. Wlsm.

Hab. TENERIFE: Santa Cruz, 29. IV. 1907. Unique.

The most persistent efforts to secure another specimen of this very distinct species were unsuccessful.

25. (348·02) EPANASTASIS, gn. n.

(ἐπανάστασίς = rebellion.)

Type *Holcopogon sophroniellus* Rbl.

Antennae nearly as long as the forewings, slightly serrate; without pecten. *Maxillary Palpi* short, dependent. *Labial Palpi* clothed with projecting scales beneath, these extending beyond the base of the terminal joint; terminal joint not more than half the length of median, smooth. *Haustellum* well-developed. *Head* and *Thorax* smooth. *Forewings* elongate, lanceolate, the dorsum slightly more convex than the costa: *neuration* 12 veins; 7 and 8 stalked, 7 to termen; rest separate. *Hindwings* 1, apex slightly depressed, termen very oblique, almost sinuate, flexus moderately developed; cilia 1: *neuration* 8 veins; 6 and 7 long-stalked; 3 and 4 stalked. *Abdomen* smooth. *Legs*, hind tibiae slightly hairy above.

Has much the appearance of *Apiletria* Ldr., to which it is closely allied, but differs in having vein 7 of the forewings to termen, in which it agrees with *Symmoca* Hb.; differing from *Symmoca*, as also from *Apiletria*, in its more roughly clothed palpi, with much shorter terminal joint.

49. (3022·02) EPANASTASIS SOPHRONIELLA Rbl.

Holcopogon sophroniellus Rbl. Ann. KK. Hofmus. IX. 18, 89–90 no. 174 (1894)[1]: XI. 128–9, 147 no. 196, Pl. **3** · 10–10[a] (1896)[2]: XIII. 381 no. 210 (1899)[3]: XXI. 44 no. 217 (1906)[4]: Stgr-Rbl. Cat. Lp. Pal. II. 160 no. 2980 (1901)[5].

Type ♂ (61057) Mus. Wlsm.

Hab. **Canaries**[1-5] — TENERIFE[1-5]: IV. 1885 (*Leech*)[1]—GRAN CANARIA[2-5]: Teror, 10. V. 1895 (*Hedemann*)[2].

Despite persistent search I did not meet with this species.

26. (348) SYMMOCA Hb.

50. (3035·1) SYMMOCA CANARIENSIS Rbl. (Plate LII. fig. 1.)

Symmoca canariensis Rbl. Ann. KK. Hofmus. XXI. 38–9, 44 no. 218 (1906)[1].

Hab. TENERIFE[1]: 1905 (*W. W. White*)[1]; Santa Cruz, 4–29. II. 1907 (*Wlsm.*), 3. IV. 1904 (*Eaton*), 29. IV. 1907 (*Wlsm.*); Guimar, 2. III – 14. IV. 1907 (*Wlsm.*); Arafo, 13–14. IV. 1907 (*Wlsm.*); Puerto Orotava, 21. IV – 10. V. 1907 (*Wlsm.*); La Laguna, 23. V. 1907 (*Wlsm.*).

I carefully examined the single specimen, in Mr. White's collection, at Guimar, which is the type of *Symmoca canariensis* Rbl., and bearing in mind the appearance of *Holcopogon sophroniellus* Rbl., at first imagined they must be the same, but, although I cannot agree with Prof. Rebel in placing *sophroniellus* in the genus *Holcopogon* Stgr. (which has been wrongly included in the *Gelechiadae*, and must be removed to the *Hyponomeutidae*), the shorter terminal joint of the palpi, even without other more important characters, is at once sufficient to separate it from the *Symmoca*. I found *S. canariensis* almost the commonest insect in the Island; it was abundant at Santa Cruz and Guimar, but I have no clue to the habits of the larva.

A fine series of 64 specimens exhibits considerable variation: in some the costal margin is broadly and conspicuously darkened, in contrast to the dull white ground-colour; in others a suffusion extends more or less over the whole wing; while in others again there is a yellowish streak along the cell, or sometimes two pairs of obliquely placed fuscous spots, before and beyond the middle, recalling vividly the pattern of *oxybiella* Mill., but more obliquely placed than in that species, and exhibiting scarcely any of the yellowish scales which are there to be found on the outer edge of the spots. Some of the smaller and more suffused varieties show a faint indication of these spots and approach very closely, except in colour, the only two specimens which I am obliged to eliminate from my series and to describe under another name (*aegrella*, sp. n.). *S. canariensis* was not found at the time and place where the new species occurred.

51. (3035·2) SYMMOCA AEGRELLA, sp. n. (Plate LII. fig. 2.)

Antennae and *Palpi* sandy ochraceous. *Head* and *Thorax* pale ochreous. *Forewings* sandy ochreous, dusted with fawn-brownish scales, slightly more thickly above and below than upon the cell; cilia pale sandy ochreous. *Exp. al.* 13–14 mm. *Hindwings* shining, pale straw-ochreous, a little more brownish toward the apex; cilia very pale sandy ochreous. *Abdomen* and *Legs* pale sandy ochreous.

Type ♂ (99009) Mus. Wlsm.

Hab. TENERIFE: La Laguna, 9. VI. 1907. Two specimens.

This species, which agrees with *canariensis* in having veins 3 and 4 of the forewings short-stalked, differs in its ochreous, rather than whitish, or greyish, colouring; in its paler and more ochreous hindwings, and in the absence of a dark shade along the outer side of the median joint of the palpi, which are also somewhat more slender in appearance.

27. (347) EPIDOLA Stgr.

52. (3019) EPIDOLA STIGMA Stgr.

Epidola stigma Stgr. Stett. Ent. Ztg. XX. 244 no. 93 (1859)[1]; Stn. Tin. S-Eur. 141, 152 no. 32 (1869)[2]; Stgr-Rbl. Cat. Lp. Pal. II. 162 no. 3019 (1901)[3].

Hab. S. EUROPE—CORSICA: Punta Parata, ⊕ *Frankenia pulverulenta*, 7. VI, excl. 1. IX. 1899 (*Wlsm.*); Ajaccio, ⊕ *Crithmum maritimum*, 10. VI, excl. 7. IX. 1899 (*Wlsm.*)—S. SPAIN[1-3]: Chiclana, ⊕ *Quercus coccifera*, IV, excl. VI (*Stgr.*)[1-2]; Coto, Granada, ⊕ *Cistus*, *Helianthemum*, IV–V. 1901 (*Wlsm.*). N. AFRICA—MOROCCO: Tangier, ⊕ 29. II. 1902 (*Wlsm.*); Cape Spartel, ⊕ on palings, 14. IV. 1902 (*Wlsm.*)—ALGERIA: Constantine (*Stgr.*). **Canaries**—TENERIFE: Santa Cruz, ⊕ on rocks, 30. I – 10. V. 1907 (*Wlsm.*).

I found, at different dates, six cases of this species on the rocks, above the Hotel Quisisana at Santa Cruz, but failed to rear any of them, repeating my previous experience as to the difficulty of breeding it. From more than a hundred cases, collected at Granada, not a single specimen emerged; but the few cases previously found in Corsica all produced the moth in due course. I am quite at a loss to account for the failures. Similar cases are made by species of the Australian genus *Ocystola* Meyr. (*Oecophoridae*).

II. BLASTOBASIDAE.

28. (351) BLASTOBASIS Z.

Prof. Rebel recorded the occurrence of *Blastobasis roscidella* Z. in the Canaries [Ann. KK. Hofmus. IX. 18, 90 no. 177 (1894)], on the strength of a specimen (61060) received from me in 1893. This was one of a series of seven specimens (61058–64) taken in Tenerife, by the late Mr. J. H. Leech, in April 1885, and is now recognised as *Scythris fasciatella* Rgt. (3536), *vide* no. 86, p. 973.

53. (3054) BLASTOBASIS PHYCIDELLA Z.

Oecophora (*Scythris*) *phycidella* Z. Isis **1839**. 193 no. 35[1]. *Blastobasis phycidella* Stgr-Wk. Cat. Lp. Eur. 309 no. 2303 (1871)[2]; Mill. Cat. Lp. Alp-Mar. 346 (1875)[3]; Hrtm. MT. Münch. Ent. Ver. IV. 33 no. 2303 (1880)[4]; Srhgn. Kleinschm. MBrndbg. 221–2 no. 305 (1886)[5]; MP-FT. Nat. Sic. VIII. 187 (1889)[6]; Meyr. Ent. Mo. Mag. XXVII. 59 (1891)[7]. *Blastobasis ? phyci-*

della Rbl. Ann. KK. Hofmus. VII. 276, 283 no. 60 (1892)[8]. *Blastobasis phycidella* Rbl. Ann. KK. Hofmus. IX. 18, 90 no. 176 (1894)[9]: XXI. 44 no. 220 (1906)[10]; Sbld. Deutsche Ent. Zts. Iris XI. 317 (1898)[11]; Stgr-Rbl. Cat. Lp. Pal. II. 163 no. 3054 (1901)[12].

Hab. WC. ASIA[2, 9, 12]. S. EUROPE[1-4, 6, 8-9, 12] — GERMANY[1-2, 4-5, 12]—S. AUSTRIA[2, 12]—SWITZERLAND[12]—ITALY[2]: San Remo, 2. IV. 1893 (*Wlsm.*); Rome, 10–25. IV. 1893 (*Wlsm.*)—SICILY[1, 6]—CORSICA: Ajaccio, 4–6. V. 1896, 16. VI. 1899 (*Wlsm.*) —S. FRANCE[3]: Cannes, 20. IV. 1890, 1. VI. 1892, ⊕ *Rubia peregrina*, excl. V. 1881 (*Wlsm.*); Napoule, 24. V. 1892 (*Wlsm.*); Thués-les-bains, 18–21. VI. 1900 (*Wlsm.*)—SPAIN[11]: GRANADA: Granada, 17. VI. 1901 (*Wlsm.*): GIBRALTAR, 3. VI. 1903 (*Wlsm.*). N. AFRICA—ALGERIA[7-9, 12]: El-Biar, 21. IV. 1893 (*Eaton*); Bône, 11. V. 1896 (*Eaton*); Azazga, 2. IX. 1893 (*Eaton*)—MOROCCO: Tangier, 2–4. V. 1902 (*Wlsm.*). **Canaries**[8-10, 12]—TENERIFE[9-10]: IV. 1885 (*Leech*)[9]; La Laguna, 23. V – 9. VI. 1907 (*Wlsm.*)—GRAN CANARIA[8-10]: (*Richter*)[8-10].

Five ♂ ♂ from La Laguna at the end of May and the beginning of June: one of these specimens (♂ 98233), with broader and more pointed wings, taken on May 23rd, is abnormally large (*exp. al.* 19·5 mm.) for a representative of this species, but it cannot otherwise be separated.

Rebel mentions a single worn ♂, with notched antennae and hindwings similar to those of *phycidella* Z., as taken at Orotava, 20. IV [*Blastobasis sp.* Rbl. Ann. KK. Hofmus. XI. 132 no. 201[b] (1896)]. He apparently regarded it as distinct from both *phycidella* and *rubiginosella*.

54. (3056) BLASTOBASIS RUBIGINOSELLA Rbl.

= *sp.* 179 Rbl.

Blastobasis sp. Rbl. Ann. KK. Hofmus. IX. 18, 91 no. 179 (1894)[1]: XXI. 44 no. 223 (1906)[2]. *Blastobasis rubiginosella* Rbl. Ann. KK. Hofmus. XI. 130–1, 147 no. 200, Pl. **3** · 12 (1896)[3]: XXI. 44 no. 221 (1906)[4]: Stgr-Rbl. Cat. Lp. Pal. II. 163 no. 3056 (1901)[5].

Hab. TENERIFE[1-5]: IV. 1885 (*Leech*)[1]; Guimar, 4. III – 16. IV. 1907 (*Wlsm.*); La Laguna, 8. IV. 1904 (*Eaton*), 7. VI. 1907 (*Wlsm.*); Puerto Orotava, 21. IV. 1895 (*Hedemann*)[3], 30. IV. 1907 (*Wlsm.*); Las Mercedes, 29. V – 7. VI. 1907 (*Wlsm.*); Tacaronte, 31. V. 1907 (*Wlsm.*).

Twenty-eight specimens were taken at Guimar, Tacaronte, Puerto Orotava, Las Mercedes, and La Laguna, from March 4th to June 7th, but the larva remains unknown.

The specimen mentioned by Rebel as *Blastobasis sp.* 179 (*l. c.* **1**) is in my collection (♂ 61053); it is undoubtedly a worn ♂ of *rubiginosella*; the type of the species, when subsequently described, having been a ♀.

55. (3056·1) BLASTOBASIS VELUTINA, sp. n. (Plate LII. fig. 4.)

Antennae and *Palpi* ash-grey, the latter sprinkled with black scales. *Head* and *Thorax* ash-grey. *Forewings* ash-grey, with a short square patch of black scales at the base of the costa, followed at a distance equal to its own length by a broad transverse band of black scales, some conspicuously raised, especially along its outer edge, which is convex and reaches nearly to the middle of the wing; its inner edge approaches nearer to the base on the dorsum than on the costa; beyond this patch, which in some specimens appears divided into two fasciae, the wing is much more sparingly bestrewn with black scales, which however are somewhat thickened on the margins at three-fourths, and around the apex; cilia brownish cinereous. *Exp. al.* 11–14 mm. *Hindwings* brownish grey; cilia brownish cinereous. *Abdomen* ash-grey, shaded at the sides and posteriorly with black; pale cinereous beneath. *Legs* brownish cinereous, the tarsi blackish, with whitish cinereous annulations.

Type ♂ (98258); ♀ (98263) Mus. Wlsm.

Hab. TENERIFE: Guimar, 9–30. III. 1907; Tacaronte, 31. V. 1907; La Laguna, 9. VI. 1907. Four specimens.

Allied to *rubiginosella* Rbl., but distinguished by the broad, dark, transverse band *before* the middle of the wing. The antennae are deeply notched in the ♂.

56. (3060) BLASTOBASIS FUSCOMACULELLA Rgt.

=*seeboldiella* Kreithn.[4]; =**marmarosella* Rbl. (nec Wlstn.)[3-4].

Oecophora fuscomaculella Rgt. Bull. Soc. Ent. Fr. XLVIII. (5 s. IX: **1879**). p. cxli (1880)[1]. *Oecophora seeboldiella* Kreithner Verh. ZB. Ges. Wien XXXI. SB. 20–1 (1881)[2]. *Blastobasis marmarosella* Rbl. Ann. KK. Hofmus. VII. 276–8, 283 no. 61. Pl. **7** · 6–6a ♀ (1892)[3]: IX. 18, 90–1 no. 178 (1894)[4]. *Blastobasis fuscomaculella* Wlsm. Tr. Ent. Soc. Lond. **1894**. 538, 549 no. 47 (1894)[5]; Rbl. Ann. KK. Hofmus. XI. 130, 147 no. 199 (1896)[6]. Sbld. Deutsche Ent. Zts. Iris XI. 317. Pl. **11** · 15 (1898)[7]. *Blastobasis fuscomaculella* Rbl. Ann. KK. Hofmus. XIII. 377, 381 no. 213 (1899)[8]: XXI. 44 no. 224 (1906)[9]: Stgr-Rbl. Cat. Lp. Pal. II. 163 no. 3060 (1901)[10].

Hab. SPAIN[2-5, 7, 10]: Bilbao[2-4, 7], V[7], VII[2], VIII[7] — PORTUGAL[1, 5, 10]: Coimbra[1]. **Madeiras** — MADEIRA[5, 10]. **Canaries**[3-6, 8-10] — TENERIFE[3-4, 6, 8-9]: IV. 1885 (*Leech*)[4]; La Laguna, 23. V–7. VI. 1907 (*Wlsm.*), VI. (*Cabrera*)[4]; Puerto Orotava, IX. 1889 (*Simony*)[3, 8] — HIERRO[8]: Valverde, 9–14. II. 1898 (*Hintz*)[8].

This is apparently a scarce species, I only met with three specimens. Valverde is in Hierro, not in Tenerife.

29. (351·1) PROSTHESIS, gn. n.

(πρόσθεσις = an addition.)

Type *Prosthesis exclusa*, sp. n.

Antennae with pecten; ♂ simple, or minutely ciliate, not notched, nor attenuate at the base. *Maxillary Palpi* short, converging. *Labial Palpi* recurved, reaching above the vertex, closely clothed; terminal joint shorter than median. *Haustellum* scaled at the base. *Head* and *Thorax* smooth. *Forewings* narrow, elongate, evenly lanceolate: *neuration* 12 veins; 7 and 8 stalked, to costa. *Hindwings* nearly as broad as the forewings, acutely lanceolate, the costa straighter than the dorsum: *neuration* 7 veins (3 and 4 coincident); (3 + 4) and 5 stalked; 6 and 7 remote, almost parallel. *Abdomen* smooth. *Legs*, hind tibiae moderately hairy.

This genus agrees with *Blastobasis* Z., *Epistetus* Wlsm., and *Zenodochium* Wlsm. in having 3 and 4 of the hindwings coincident, stalked, or connate, with 5. It differs from *Epistetus* and *Zenodochium* in having a pecten instead of a conchoidal shield of scales on the basal joint of the antennae, and from *Blastobasis*, with which it agrees in having a pecten on the basal joint, in the absence of a notch.

57. (3067·1) Prosthesis exclusa, sp. n. (Plate LII. fig. 5.)

Antennae stone-whitish. *Palpi* stone-greyish, sprinkled with fuscous; the median joint fuscous on its outer side nearly to the apex. *Head* and *Thorax* stone-grey. *Forewings* pale stone-grey, sparsely sprinkled with fuscous and rust-brown scales; a small spot at the base of the costa, a narrow fascia at one-third from the base, much mixed with rust-brown and strongly angulated outward on the cell, whence it runs nearer to the base on the dorsum than on the costa; at two-thirds a rather strong group of fuscous and brownish scales, on the dorsum, is more or less connected by scattered scales across the wing to a smaller costal spot a little nearer to the apex, and these again are more or less connected with each other by a chain of six or seven obscure marginal spots running around the apex; cilia pale brownish grey. *Exp. al.* 12–14 mm. *Hindwings* grey; cilia brownish grey. *Abdomen* greyish fuscous, with narrow, shining, pale steely grey, transverse bands. *Legs* stone-greyish, thickly speckled with brownish fuscous on their outer sides.

Type ♂ (98291); ♀ (98298) Mus. Wlsm.

Hab. Tenerife: Puerto Orotava, 25. IV – 3. V. 1907; La Laguna, 23. V – 9. VI. 1907; Las Mercedes, 29. V – 7. VI 1907. Nineteen specimens.

30. (352·1) ZENODOCHIUM Wlsm.

ZENODOCHIUM Wlsm. Ent. Mo. Mag. XLIV. 49 (1908).

Type *Zenodochium monopetali* Wlsm.

58. (3069·2) ZENODOCHIUM POLYPHAGUM, sp. n.
(Plate LII. fig. 6.)

= *Blastobasis sp.* Rbl. Ann. KK. Hofmus. XI. 131, 147 no. 201a (1896)[1]: XXI. 44 no. 222 (1906)[2].

Antennae brownish fuscous. *Palpi* brownish fuscous, the distal end of the median joint narrowly whitish. *Head* and *Thorax* whitish, sprinkled, or sometimes entirely suffused, with brownish fuscous. *Forewings* usually dirty whitish, but varying from clear white to dull ash-colour, with brownish fuscous streaks and blotches; the usually paler basal third of the wing has a small spot at the base of the costa, one or two short length-streaks on and above the fold, and another near the dorsum, and is sometimes also profusely sprinkled with brownish fuscous scales; at one-third occurs a slightly inverted triangular costal spot, between which and an ill-defined, outwardly oblique, dorsal patch the paler ground-colour asserts itself in a narrow, oblique, separating band; on the median area is a short length-streak along the upper edge of the cell, and much sprinkling (sometimes considerable suffusion) of brownish fuscous; at three-fourths is a transverse, narrow, brownish fuscous band, slightly inverted from costa to dorsum, and sometimes interrupted below the costa, and beyond is another short median length-streak and a series of about six dentate streaks around the margin; cilia hoary, faintly sprinkled and narrowly striated with brownish grey. *Exp. al.* 13–20 mm. *Hindwings* brownish grey; cilia shining, yellowish brown along their base, greyer beyond. *Abdomen* grey. *Legs* brownish grey.

Type ♂ (98227); ♀ (98221); *PT.* var. ♂ (98210) Mus. Wlsm.

Hab. TENERIFE[1-2]: Puerto Orotava, 24. IV. 1895 (*Hedemann*)[1], 23. IV – 7. V. 1907, ⊕ in refuse on *Artemisia canariensis*, 27. III, excl. 4. VI – 2. VIII. 07, ⊕ *Allagopappus dichotomus*, 4. IV, excl. 4. V – 4. VII. 07, ⊕ *Senecio kleinia*, IVe, excl. 13–31. V. 07, ⊕ *Sonchus gummifer*, 23. IV, excl. 23. VI. 07, ⊕ *Pinus canariensis*, 20. IV, excl. 19. V – 11. VI. 07, ⊕ *Rubia fruticosa*, II, excl. 18. V. 07, ⊕ *Cytisus proliferus*, 22. IV, excl. 29. IV – 10. VI. 07, ⊕ *Rhus coriaria*, 28. IV, excl. 6. VI. 07 (*Wlsm.*); Bajomar, 26. V. 1907 (*Wlsm.*). Thirty-six specimens (33 bred, 3 captured).

The species varies much in the amount of sprinkling, or suffusion, of brownish fuscous on the ashy ground-colour, some of the whiter varieties being more plainly marked than others, but all possess the oblique pale separating line between the costal triangle and dorsal blotch. In appearance it reminds one rather of *Tecmerium anthophagum* Stgr., but its nearest ally is *Zenodochium xylophagum* Wlsm., a much darker species with indistinct markings. I bred thirty-six specimens from accumulated refuse on *Artemisia canariensis* (3), *Allagopappus dichotomus* (13), *Senecio kleinia* (4), and *Sonchus gummifer* (1)—**Compositae**; *Pinus canariensis* (6)—**Coniferae**; *Rubia fruticosa* (1)—**Rubiaceae**; *Cytisus proliferus* (4)—**Leguminosae**; and *Rhus coriaria* (1)—**Terebinthaceae**; these are, I believe, all plants indigenous to the Island. The larva frequently bores into the stem of the food-plant before pupation, leaving a hole from which the imago escapes.

III. OECOPHORIDAE.

31. (369·01) AGONOPTERYX Hb.

Forewings: 2 and 3 stalked; 7 and 8 stalked.

Type *Pyralis ocellana* F.

=†*AGONOPTERIX* Hb. (Type *ocellana* F.); =PINARIS Hb. (Type *arenella* S-D.); =TICHONIA Hb. (Type *atomella* S-D.); =EPELEUSTIA Hb. (Type *liturella* Hb.); =HAEMYLIS Tr. (Type *assimilella* Tr.); =**VOLUCRA* Z. (*conterminella* Z.), nec Ltr.; = *DEPRESSARIA* (A) Meyr.

Wallengren [Entomologisk Tidskrift II. 81 (1881)] described the new genus *Siganorosis* for species agreeing with *heracliana* DG. in having veins 2 and 3 of the forewings separate, thus restricting the use of *Depressaria* Hw. to species with 2 and 3 stalked. Unfortunately he overlooked the fact that in 1828 Curtis had cited *heracleana* as the type of *Depressaria* Hw., and figured its neuration. *Siganorosis* Wlgrn. must therefore sink as a synonym of *Depressaria* Hw., and also of *Volucra* Ltr. The species having 2 and 3 of the forewings stalked form a natural and easily recognisable genus and should be known as *Agonopteryx* Hb.

59. (3193·1) AGONOPTERYX CINERARIAE, sp. n.
(Plate LII. fig. 7.)

Antennae ochraceous, much clouded beyond the base with smoky fuscous. *Palpi* pale ochreous, the terminal joint minutely tipped with black, and having a black band around it above the middle. *Head* and tufted *Thorax* pale ochreous. *Forewings* with the costa moderately convex, apex depressed, termen oblique; pale ochreous, with a few darker fawn-ochreous shades tending to define the neuration; more or less profusely sprinkled with scattered black dots, some being placed along the termen, some on the costa, one on the costa beyond the middle, in position to form an equilateral triangle with two others on the disc, above and near the first of which is sometimes a blackish patch; a small black marginal spot also lies near the base of the dorsum. *Exp. al.* 17–20 mm. *Hindwings* very pale, shining, whitish ochreous; cilia still paler. *Abdomen* and *Legs* pale straw-ochreous.

Type ♂ (99011); *PT.* var. ♂ (99012) Mus. Wlsm.

Hab. TENERIFE: Arafo, 13. IV. 1907 (*Wlsm.*); Barranco Lorez, near Orotava, ⊕ *Senecio* (*Cineraria*) *populifolius*, 7. V, excl. 11–20. VI. 1907 (*Wlsm.*). Seven specimens.

Larvae found in April and May, at Guimar and near Orotava, on *Senecio* (*Cineraria*) *populifolius* and *heritieri*, mining between the upper and under surfaces of the leaves, causing a slightly puckered appearance, but very difficult to detect owing to their pale greenish white colour. Six specimens bred in June, and a single ♂ taken on the wing above Arafo, April 13th.

Allied to *assimilella* Tr., but easily separated by the distinct black spotting on the under side of the costa of the forewings, which are, as are also the hindwings, much paler than in that species.

60. (3201·1) AGONOPTERYX CONCILIATELLA Rbl.

Depressaria conciliatella Rbl. Ann. KK. Hofmus. VII. 272–4, 283 no. 55. Pl. **17** · 14 ♀ (1892)[1]; Wlsm. Tr. Ent. Soc. Lond. **1894**. 538, 546 no. 40 (1894)[2]; Stgr-Rbl. Cat. Lp. Pal. II. 171 no. 3223 (1901)[3]: Rbl. Ann. KK. Hofmus. XXI. 44 no. 226 (1906)[4].

Hab. SICILY[1–3]: Palermo[1]. **Madeiras**[2–3]—MADEIRA[2]: Funchal; The Mount (*Wollaston*)[2]. **Canaries**[1–4]—TENERIFE[1]: Agua Mansa and Pedro Gil, ⊕ *Cytisus proliferus*, 20. IV, excl. 20–23. V. 1907 (*Wlsm.*); Pedro Gil, 1420 m., 30. VII. 1889 (*Simony*)[1]—GRAN CANARIA[1]: San Mateo, 805 m., 7. VIII. 1890 (*Simony*)[1].

The only named species, of the unrestricted genus *Depressaria*, recorded by Rebel in his complete list (1906) is *conciliatella*. In 1894 (*l. c.* **2**), I wrote that if I had rightly identified this species it was very variable. I have now two specimens, bred from larvae feeding in the leading shoots of *Cytisus proliferus*, from Pedro Gil and Agua Mansa respectively, which are much darker than the Madeiran examples, but not distinguishable in the position and character of the markings. Professor Rebel, throughout his description, compares *conciliatella* with "*yeatiana* F.," but it is much more nearly allied to *scopariella* Hnm., from which indeed some of the less speckled varieties are almost indistinguishable. The easiest way to separate them is by the costal markings on the underside: in *conciliatella* there is a wide pale band around costa and termen, much peppered and streaked with fuscous along the basal half of the costa: in *scopariella* the pale band is narrower and decidely less speckled.

61. (3222) AGONOPTERYX YEATSANA F.

=† *yeatiana* F., ‡ *yeatsana*. (T. P. Yeats, *nom. pr.*)

Pyralis yeatiana F. Sp. Ins. II. 286 no. 60 (1781)[1]. *Depressaria yeatiana* Rbl. Ann. KK. Hofmus. VII. 272–4 (1892)[2]; Stgr-Rbl. Cat. Lp. Pal. II. 171 no. 3222 (1901)[3].

Hab. C–S. EUROPE[1–3] — CORSICA: Corté, ⊕ *Heloscyadium* *sp.*, 7. VI, excl. 20. VI. 1898 (*Wlsm.*)—S. FRANCE: R. Var, ⊕ *Peucedanum palustre*, 10. IV, excl. 18. VI. 1896 (*Wlsm.*). N. AFRICA—MOROCCO: Tangier, ⊕ *Heracleum sp.?*, 24 IV, excl. 19. V. 1902 (*Wlsm.*). **Canaries** — TENERIFE: Puerto Orotava, 4. V. 1907, ⊕ *Umbellifer*, 9. V, excl. 10. VI. 1907 (*Wlsm.*).

Six specimens taken, and one bred from an Umbellifer, growing under dripping rocks on the sea-coast, near Orotava. The plant appeared to be the same as that from which I bred this species in Corsica, in 1898, and which was named for me at the time "*Heloscyadium sp.*", but I am not sure that the species occurs in Tenerife: in any case my botanical knowledge is quite inadequate to decide the point from such specimens as were available at the date on which the larva was found near Orotava. My experience is, that this species occurs only on marshy ground; I have also bred it from *Peucedanum palustre*, gathered at the mouth of the Var, on the Riviera, and from *Heracleum sp.*, at Tangier.

62. (3232·1) AGONOPTERYX PEREZI, sp. n. (Plate LII. fig. 8.)

=**applana* Wlsm. (nec F.).

Depressaria applana Wlsm. Tr. Ent. Soc. Lond. **1894**. 538, 546 no. 41 (1894)[1].

Antennae smoky fuscous. *Palpi* cinereous, the median joint thickly sprinkled with black and tawny on the outer side, except in a narrow band around its upper end; terminal joint with a narrow black band around its base, a broader one before its apex, and the extreme apex minutely black. *Head* and *Thorax* cinereous, more or less tinged with fuscous; the latter with an elevated crest posteriorly. *Forewings* tawny reddish fuscous, with smoky black suffusion and speckling; a pale ochreous patch at the extreme base, its outer edge straight and black-margined to the upper edge of the cell, above which it is angulated and produced outward along the costa, and gradually absorbed in the darker ground-colour; on the cell, at one-third, are two clearly defined, almost contiguous, but obliquely diverging, black spots, the lower one slightly beyond the upper— both followed by a few ochreous scales, produced and broken into two spots, in line with the lower one on the cell; the slightly paler costa is obscurely spotted with dark fuscous throughout, and the termen is also narrowly spotted, the fuscous shading on the wing tending to follow and indicate the neuration; cilia corresponding in colour to the wing-surface; underside shining, sericeous, the costa and termen strongly speckled with fuscous. *Exp. al.* 16–20 mm. *Hindwings* and cilia shining, pale cinereous, the cilia with slender parallel shade-lines running through them; underside shining, sericeous, the costa and termen strongly speckled with fuscous. *Abdomen* and *Legs* pale cinereous, the tarsi with four fuscous bands.

Type ♂ (99018); ♀ (99019) Mus. Wlsm.

Hab. **Madeiras**[1]—Madeira[1]. **Canaries**—Tenerife: Puerto Orotava, ⊕ *Ruta pinnata*, 14. V, excl. 4. VI – 1. VII. 1907 (*Wlsm.*). Twenty-four specimens.

The pale green larva rolls the leaves of *Ruta pinnata*, an indigenous and somewhat local plant, to which my attention was specially called by my friend Dr. George Perez, after whom I have named this *Agonopteryx*, and whose great assistance in the botanical work connected with my study of the Tenerife Lepidoptera I gratefully acknowledge.

As compared with *Agonopteryx applana* F., the chief points of difference noticeable in *perezi* are that the pale basal patch is sharply angulate (not curved outward) at the radius, along and above which are some distinctly ochreous scales; the discal spots are yellowish, not white, and the antennae are shorter. Looking again at the rather poor specimen which I recorded from Madeira, as *applana*, in 1894, I am now inclined to regard this as *perezi*.

32. (369) DEPRESSARIA Hw.

Forewings: 2 and 3 separate; 7 and 8 stalked.

Type *Phalaena Tortrix heracleana* (L.) DG., F., Hw.

Depressaria Hw. (Type *heracleana* Hw.); =*Pyralis* F. (II.) Ltr.; [=*Piesta Blbg.* (Type *heracleana* L.) *LN.*]; =‡"*Pyrale, Volucre*" Ltr. (Type *heracleana* F.); =*Volucra* Ltr. (Type *heracleana* F.); =*Siganorosis* Wlgrn. (Type *heracleana* L., Wlgrn.); =Depressaria (B) Meyr.

63. (3299·1) Depressaria tenerifae, sp. n. (Plate LII. fig. 9.)

=*Depressaria sp.* Rbl. Ann. KK. Hofmus. XXI. 39, 44 no. 227 (1906)[1].

Antennae smoky fuscous. *Palpi* cinereous, densely speckled with smoky fuscous externally, and with a fuscous ring above the middle of the terminal joint. *Head* and *Thorax* pale slaty greyish, more or less sprinkled with tawny fuscous. *Forewings* slaty greyish, suffused, and obscurely blotched, with smoky fuscous; a very dark patch at the base, below the fold, leaving a narrow pale margin within it, is diluted upward and outward, and followed by two clouds of a similar colour on the cell, one before and one beyond the middle, of which the first is the darker, owing to black scaling continued from its lower edge in a series of two or three small spots reaching to the end of the cell; beyond the cell is a strong, outwardly curved, dark fuscous shade, preceding the speckled margin and cilia, the latter are delicately rosy-tipped. *Exp. al.* 17–19 mm. *Hindwings* and cilia pale, shining, rosy cinereous. *Abdomen* and *Legs* shining, cinereous; the tarsi with four fuscous bands.

Type ♀ (99020); ♂ (99021); ⊕ (99022) Mus. Wlsm.

Hab. Tenerife: 1905 (*White*)[1]; Santa Cruz, ⊕*Artemisia cana-*

riensis, 11. II, excl. 19. III – 3. IV. 1907 (*Wlsm.*); Guimar, ⊕ *Artemisia canariensis*, 25. III, excl. 9. IV – 23. V. 1907 (*Wlsm.*). Sixteen specimens.

Bred from a rather stout green larva, feeding in the leading shoots of *Artemisia canariensis*, at Santa Cruz and Guimar. As compared with the European species which feed on *Artemisia*, it is distinctly more suffused in its colouring, the darker patches being unaccompanied by any lines of whitish scales; indeed the whole insect has a much more silky, smooth appearance, with some gloss, not only in the hindwings, but also on the anterior pair. It is perhaps nearest to *absinthivora* Frey, but the absence of any outward elongation of the median shade is a good character by which it may readily be distinguished.

64. (3306) Depressaria apiella Hb.

=*nervosa* Hw.; =**heracliana* Wlsm. (nec DG.).

Tinea apiella Hb. Smlg. Eur. Schm. VIII. (Tin.). 39. Pl. **14** · 94 (1796)[1]. *Depressaria nervosa* Hw. Lp. Br. 506 no. 4 (1811)[2]. *Pinaris apiella* Hb. Verz. Schm. 411 no. 3966 (1826)[3]. *Depressaria nervosa* Wlsm. Pr. Z. Soc. Lond. **1881**. 317 (1881)[4]. *Depressaria *heracliana* Wlsm. Tr. Ent. Soc. Lond. **1894**. 538, 546 no. 42 (1894)[5]. *Depressaria nervosa* Stgr-Rbl. Cat. Lp. Pal. II. 174 no. 3306 (1901)[6]; Busck, Pr. US. Nat. Mus. XXIV. 747 no. 34 (1902)[7]; Dyar Bull. US. Nat. Mus. **52**. 522 no. 5887 (1902)[8].

Hab. EUROPE[1-3]. N. AFRICA—Morocco: Tangier, ⊕ *Ferula sp.*, excl. 19. V. 1902 (*Wlsm.*); ⊕ *Oenanthe peucedanifolia*, 6. V, excl. 7–15. VI. 1902 (*Wlsm.*); ⊕ *Thapsia garganica*, 9. V, excl. 7. VI. 1902 (*Wlsm.*). **Madeiras**[5]—Madeira: (*Wollaston*)[5]. **Canaries**—Tenerife: Guimar, ⊕ *Bupleurum aciphyllum*, 6. III, excl. 16. IV. 1907 (*Wlsm.*); ⊕ *Umbellifer*, 14. IV, excl. 22. V. 1907 (*Wlsm.*). UNITED STATES[4, 7-8]—Oregon[4, 7-8]: grant co.: Camp Watson, IV[m]. 1872 (*Wlsm.*): jackson co.: near Rogue River, 4–6. V. 1872 (*Wlsm.*).

For more than half a century *apiella* Hb. (1796) has been sunk as a synonym of *nervosa* Hw. (1811): so long as these two names are held to pertain to the same species, it is obvious that that species must be named *apiella* Hb.

Two specimens bred from an *Umbellifer*, found at Guimar, and one from the rare *Bupleurum aciphyllum* (=*salicifolium*) appear to be inseparable from this species: they agree exactly with specimens bred in Morocco, in 1902, from *Ferula*, *Oenanthe peucedanifolia*, and *Thapsia garganica*, and are only distinguished from my European series by their slightly larger size and darker colour, partly due to the freshness of the specimens. This species has not been met with in the United States since 1872, when I took two specimens in Oregon. I again refer to these two specimens to give the exact localities, viz., (91970) Camp Watson, Grant Co., in Northern Oregon, taken in April 1872, and (91971) taken in Jackson Co., in Southern Oregon, 4–6 June 1872, when near Rogue River. These two American specimens have vein 5 of the hindwings out of the stalk of 3 and 4, in which they agree with Canary, Tangier, Madeira, and European specimens which have 5 connate with, or out of the stalk of 3 and 4; a character which occurs also in *discipunctella* HS. (=**pastinacella* Stn.). The specimen recorded by me from Madeira in 1894 (*l. c.* 5) as "*Siganorosis heracliana* DG." is a bleached example of *apiella* Hb.

33. (365) ETHMIA Hb.

=*PSECADIA* Hb., Stgr-Rbl.

65. (3143) ETHMIA BIPUNCTELLA F.

Alucita bipunctella F. Ent. Syst. 668 no. 7 (1775)[1]. *Psecadia bipunctella* Rbl. Ann. KK. Hofmus. VII. 272, 283 no. 54 (1892)[2]: IX. 18, 89 no. 168 (1894)[3]: XIII. 377, 381 no. 201 (1899)[4]: XXI. 44 no. 225 (1906)[5]: Stgr-Rbl. Cat. Lp. Pal. II. 167 no. 3143 (1901)[6].

Hab. W. ASIA[2-3, 6]. C. and S. EUROPE[1-3, 6]—S. SPAIN: HUELVA: Coto, 23. IV. 1901 (*Wlsm.*). N. AFRICA[2-3, 6]—MOROCCO: Tangier, 11. II. 1902 (*Wlsm.*)—ALGERIA: Le Tarf, 29. VI. 1896 (*Eaton*). **Canaries**[2-6]—TENERIFE[3-5]: Santa Cruz, 6–12. I. 1907, ⊕ *Symphytum*, 14. I – 13. II, excl. 5. IV. 1907 (*Wlsm.*), 30. IV. 1898 (*Hintz*)[4]; Las Mercedes, 7–29. III. 1904 (*Eaton*); La Laguna, 12. VI. 1889 (*Krauss*)[3]—GRAN CANARIA[2-5]: (*Richter*)[2-5].

Taken on the wing, and bred at Santa Cruz.

33a. (376) HARPELLA Schrk.

65a. (3329) HARPELLA FORFICELLA Sc.

Phalaena forficella Sc. Ent. Carn. 248 no. 638 (1763)[1]. *Harpella forficella* Rbl. Ann. KK. Hofmus. VII. 276, 283 no. 59 (1892)[2]: XXI. 44 no. 228 (1906)[3]: Stgr-Rbl. Cat. Lp. Pal. II. 176 no. 3329 (1901)[4].

Hab. C–S. EUROPE[1-4]. **Canaries**[2-4]—(*? GRAN CANARIA*[2]).

I did not meet with this species in Tenerife.

IV. HYPONOMEUTIDÆ.

34. (412) COLEOPHORA Hb.

66. (3713) COLEOPHORA OROTAVENSIS Rbl.

Coleophora orotavensis Rbl. Ann. KK. Hofmus. XI. 137–8, 147 no. 214, Pl. **3** · 16 ♀ (1896)[1]: XXI. 44 no. 234 (1906)[2]: Stgr-Rbl. Cat. Lp. Pal. II. 193 no. 3713 ((1901)[3].

Hab. TENERIFE[1-3]: Santa Cruz, 26. XII – 26. I. 1907 (*Wlsm.*); Guimar, 28. II – 12. IV. 1907 (*Wlsm.*), 24. III. 1904 (*Eaton*); Tacaronte, 1. IV. 1902 (*Eaton*); Puerto Orotava, 21–30. IV. 1905 (*Hedemann*)[1], 21. IV. 1907 (*Wlsm.*).

Exceedingly common everywhere. It seems to be attached to *Chenopodium*, and to appear in successive broods almost continuously.

67. (3713·1) Coleophora micromeriae, sp. n.

Antennae white, annulate with greyish fuscous; the basal joint roughly clothed, but not tufted. *Palpi* white, a broad greyish fuscous band spreading around the apex of the median, and base of the terminal joint, including some slightly projecting scales from the former. *Head* white, slightly shaded along the middle with greyish fuscous. *Thorax* white above; tegulae touched with greyish fuscous. *Forewings* greyish fuscous, the costa narrowly pure white from the base, widening outward, and continued to the apex, before which the costal cilia are slightly touched with grey; there is a less conspicuous line of white scaling along the fold and slightly diffused downward across the space beneath it to the dorsum, the base of the terminal cilia being also white, forming a streak which runs out through those of the apex; with this exception the cilia are pale brownish grey; the marginal white lines are clearly visible on the underside. *Exp. al.* 8–11 mm. *Hindwings* very pale bluish grey; cilia pale brownish grey, becoming whitish at their tips around the apex. *Abdomen* brownish grey above, white beneath; anal clothing whitish. *Legs* white, the hind tarsi faintly speckled.

Type ♀ (99023); ♂ (99024) Mus. Wlsm.

Hab. Tenerife: Puerto Orotava, 19. II. 1907, 5. V. 1907 (*Wlsm.*); Guimar, 27. II – 14. IV. 1907 (*Wlsm.*), ⊕ *Micromeria varia*, 23. II, excl. 10. V. 1907 (*Wlsm.*); Cruz de Afur, 5. IV. 1904 (*Eaton*); Forest de la Mina, 7. IV. 1904 (*Eaton*). Sixteen specimens, one bred.

The case is brown, short and cylindrical, sprinkled with short whitish hairs, like the leaf-surface of the food-plant; the mouth is slightly oblique. It was found on *Micromeria varia*, among which plant I took several specimens, at Guimar, at about 1200 ft. I also met with the species at Puerto Orotava, in February, and in May, and received three specimens from Mr. Eaton, taken in April 1904, at Cruz de Afur, and in the Forest de la Mina.

68. (3773) Coleophora confluella Rbl.

Coleophora confluella Rbl. Ann. KK. Hofmus. VII. 278–9, 283 no. 63, Pl. **17** · 15 ♂ (1892)[1]: XXI. 44 no. 235 (1906)[2]: Stgr-Rbl. Cat. Lp. Pal. II. 195 no. 3773 (1901)[3].

Hab. **Canaries**[1-3]—La Palma[1, 3]: Pico del Berigoya, 1400–1500 m., 21. VIII. 1889 (*Simony*)[1]—Tenerife: Guimar, ⊕ *Helianthemum guttatum*, 27. III, excl. 25. IX – 1. X. 1907 (*Wlsm.*); La Laguna, ⊕ *Helianthemum guttatum*, 3. V. 1907 (*Wlsm.*).

Larvae were common, in cases made of leaves (similar to those of *helianthemella* Mill.), on *Helianthemum guttatum*, and also on

Cistus monspeliensis. I found numerous cases at Guimar, at the end of March, from which I bred two specimens only at the end of September and the beginning of October. I have always found *helianthemella* an extremely difficult species to rear, under the conditions to which a travelling entomologist is restricted, and *confluella* presents similar difficulties, for I bred only the two specimens mentioned, although larvae were collected subsequently at La Laguna in the beginning of May.

68ª. Coleophora sp.?

Three cases found on *Adenocarpus foliolosus*, at Guimar, 26th February, were extremely similar to those of *confluella*, and might have been taken for stray specimens from the *Helianthemum*, had I not observed traces of their feeding on the leaves. They were slightly smaller than the others, but would not feed in captivity and I failed to rear them.

69. (3815·1) Coleophora aegyptiacae Wlsm.

Coleophora aegyptiacae Wlsm. Ent. Mo. Mag. XLIII. 148 no. 3815·1 (1907)[1].

Hab. Algeria: Hammam-es-Salahin, ⊕ *Salvia aegyptiaca*, III – IV, excl. IV.[1] **Canaries**—Tenerife: Santa Cruz, ⊕ *Salvia aegyptiaca*, 16. I – II. 1907.

Several cases of this Algerian species were found at Santa Cruz, at different dates in January and February, on *Salvia aegyptiaca*, but were not reared.

70. (3840·1) Coleophora teidensis, sp. n.

Antennae pale grey, with very faint paler annulations; basal joint smooth. *Palpi* greyish white; smooth, a few scales projecting from the end of the median, before the base of the short terminal joint. *Head* and *Thorax* pale silky grey. *Forewings* narrow; pale silky grey, without any ochreous or brownish scaling; a faint greyish white line, along the costa, is a little widened about the middle, but thence touches only the outer ends of the greyish costal cilia; other still fainter greyish lines running throughout the wing-length, one along the upper edge of the cell throwing three slender branches to the costa along the principal veins; one along the middle of the cell leaves the costa near the base, approaching and running parallel to the termen, another lying below it along the fold; cilia pale stone-grey. *Exp. al.* 13 mm. *Hindwings* very pale bluish grey; cilia pale stone-grey. *Abdomen* dark leaden grey. *Legs* whitish grey.

Type ♂ (99026); ♀ (99027) Mus. Wlsm.

Hab. Tenerife: Puerto Orotava, 14. V. 1907; Tacaronte, 31. V. 1907; La Laguna, 5. VI. 1907. Three specimens.

The nearest approach to this species in our European lists is *algidella* Stgr., which it greatly resembles in colouration and in the faint whitish longitudinal lines; it differs, however, decidedly in its much narrower forewings. I should place it between *algidella* Stgr. and *murinipennella* Dp.: its scarcely annulated antennae and more silky grey colour separate it from the latter.

71. (3852) COLEOPHORA ATLANTICELLA Rbl.

Coleophora atlanticella Rbl. Ann. KK. Hofmus. XI. 138–9, 147 no. 215 (1896)[1]: XXI. 44 no. 236 (1906)[2]: Stgr-Rbl. Cat. Lp. Pal. II. 198 no. 3852 (1901)[3].

Hab. **Canaries**[1-3]—TENERIFE[1-2]: Santa Cruz, 22. I – 10. II. 1907 (*Wlsm.*); Guimar, 12–30. III. 1907 (*Wlsm.*); Puerto Orotava, 27. IV. 1895 (*Hedemann*)[1] — GRAN CANARIA[1-2]: Las Palmas, 7. V. 1895 (*Hedemann*)[1].

A good series taken at Santa Cruz; I also met with it at Guimar.

72. (3895) COLEOPHORA ARTEMISIAE Mhlg.

Coleophora artemisiae Mhlg. Stett. Ent. Ztg. XXV. 163–5 (1864)[1]; Stgr-Rbl. Cat. Lp. Pal. II. 199 no. 3895 (1901)[2].

Hab. GERMANY[1-2]—AUSTRIA[2]. **Canaries**—TENERIFE: Guimar 12. IV. 1907; Puerto Orotava, 21. IV. 1907.

Six specimens taken at Puerto Orotava, and two at Guimar, among *Artemisia canariensis*.

73. (3904·1) COLEOPHORA POECILELLA Wlsm.

Coleophora poecilella Wlsm. Ent. Mo. Mag. XLIII. 129 no. 3904·1 (1907)[1].

Hab. ALGERIA: Biskra, Hammam-es-Salahin, ⊕ *Suaeda vermiculata*, IV, excl. IV – V, X.[1] **Canaries**—TENERIFE: Puerto Orotava, ⊕ *Salsola oppositifola*, 4. VI. 1907.

Three of the easily-recognisable, long, tapering, cylindrical cases, found on *Salsola oppositifolia*, at Orotava, are undistinguishable from those taken in Algeria on the allied *Suaeda vermiculata*; but again I was unable to rear them.

35. (389) BATRACHEDRA Stn.

74. (3562) BATRACHEDRA LEDERERIELLA Z.

Cosmopteryx ledereriella Z. Stett. Ent. Ztg. XI. 198 no. 220 (1850[1]. *Batrachedra ledereriella* Wlsm. Ent. Mo. Mag. XXVII. 149 (1891)[2]; Rbl. Ann. KK. Hofmus. XI. 132, 147 no. 205 (1896)[3]: XXI. 44 no. 232 (1906)[4]: Stgr-Rbl. Cat. Lp. Pal. II. 185 no. 3562 (1901)[5]; Wlsm. Ent. Mo. Mag. XXXIX. 167 (1903)[6].

Hab. WC. ASIA[6]. S. EUROPE[1-6]—S. FRANCE: Cannes,

⊕ in webbed rubbish on *Mimosa*, excl. 20. IV. 1879, ⊕ in webs of Spiders and Larvae, II–III, excl. IV. 1881, ⊕ *Juniperus oxycedrus*, III, excl. 24. V. 1890, ⊕ *Rosmarinus officinalis*, III, excl. 16. V. 1890, ⊕ old fruit of *Mespilus germanica*, excl. 12. V. 1892 (*Wlsm.*); Beaulieu, ⊕ rubbish in leafy galls on *Salix pendula*, 6. IV, excl. 5. V – 17. VIII. 1890 (*Wlsm.*)—SPAIN: MALAGA: Malaga, ⊕ in seed-heads of *Anthyllis cytisoides*, XII, excl. 2. IV. 1901, ⊕ *Genista umbellata*, 28. I, excl. 1. IV. 1901, ⊕ *Cistus albidus*, 27. I, excl. 5–8. IV. 1901 (*Wlsm.*). N. AFRICA —MOROCCO: Tangier, 11. I., 8. III., 2. V. 1902 (*Wlsm.*), ⊕ *Cistus ladaniferus*, 9. XII, excl. 30. VII. 1902 (*Wlsm.*); Cape Spartel, ⊕ seeds of *Cistus sp.*, excl. 16. VIII. 1902 (*Wlsm.*). **Canaries**[3-5] —TENERIFE[3]: La Laguna, 2. III. 1904 (*Eaton*), 7. VI. 1907 (*Wlsm.*); Guimar, 2. III – 14. IV. 1907 (*Wlsm.*); Puerto Orotava, 11. IV. 1895 (*Hedemann*)[3], ⊕ old seeds *Senecio kleinia*, 26. IV, excl. 29. IV – 10. VI. 1907, ⊕ diseased stems *Cytisus proliferus*, 24. IV, excl. 13. V. 1907, ⊕ *Pinus canariensis*, 20. IV, excl. 24–29. V. 1907, ⊕ *Mangifera indica*, 14. V, excl. 25. VI – 14. VII. 1907, ⊕ *Sonchus leptocephalus*, 30. IV, excl. 7. VII. 1907 (*Wlsm.*); Arafo, 13. IV. 1907 (*Wlsm.*)—GRAN CANARIA[3]: Las Palmas, 9. V. 1895 (*Hedemann*)[3].

Taken commonly at Guimar, and bred from *Senecio*, *Cytisus*, *Pinus*, *Mangifera*, and *Sonchus*, bearing out my previous experience of the habits of the species in Europe and Morocco, where it is invariably a rubbish-feeder, among débris of spiders' webs, and frass of other larvae on numerous plants as enumerated above.

36. (388) COSMOPTERYX Hb.

75. (3550·1) COSMOPTERYX CORYPHAEA, sp. n. (Plate LII. fig. 10.)

=*Cosmopteryx sp. n.* Wlsm. Ent. Mo. Mag. XXXVII. 237 (1901)[1].

Antennae pale buff, spotted with white along their outer sides, two black, and two white annulations occurring before a darker band, which precedes the four or five yellowish distal joints. *Palpi* white, with pale buff lateral lines throughout. *Head* olivaceous brownish, with a short central, and two longer lateral lines. *Thorax* olivaceous brown, with a central white line, and one along the inner edge of each of the tegulae. *Forewings* olivaceous brown to about three-fifths of their length, on which colour are five slender silvery white lines; one from the base of the costa, slightly diverging, and terminated below the costa at at about one-third; another, above it along the costa, slightly widened towards its outer end; a third, from the middle of the base, extending to the outer margin of the olive-brown space, whence a shorter, inverted, streak diverges, terminating opposite to the outer end of the first costal; the fifth streak is from the base, along the dorsum, and is rather shorter than the first costal;

beyond the brown space, and therefore a little beyond the middle of the wing, commences a pale lemon-yellow patch, which is continued toward the apex, bearing the following markings: first, two bright silver spots, each touching the brown preceding space, and each carrying a jet-black dot on the side opposite to it; beyond these, at a distance equal to about the middle of the wing, are two corresponding spots of bright silver scales, but with only one or two black scales attached, the yellow ground-colour extends between and beyond these, blending to creamy white along the costa and dorsum to the apex, the margins being separated by a short olive-brown dash reaching the extreme apex; cilia brownish grey. *Exp. al.* 9–10 mm. *Hindwings* pale grey; cilia brownish grey. *Abdomen* yellowish. *Legs* white, shaded externally with oblique olivaceous brownish bands.

Type ♂ (99029); ♀ (99030) *Santa Cruz*, Mus. Wlsm.

Hab. SPAIN: MALAGA: Malaga, 29. IV. 1901 (*Wlsm.*)[1]. **Canaries**—TENERIFE: Santa Cruz, 12–16. II. 1907. Eight specimens.

Nearest to *similis* Wlsm., but differing in the continuation of the yellow band beyond the outer pair of silver spots, giving the wing a much lighter appearance; in this respect it agrees with *quadrilineella* Chmb., but differs in having five white lines in the dark basal area of the wing, of these the subcostal, the median, and the dorsal arise from the base.

76. (3553) COSMOPTERYX ATTENUATELLA Wkr.

n. syn.=*flavofasciata* E. Wlstn.; =*lespedezae* Wlsm.

Gelechia attenuatella Wkr. Cat. Lp. BM. XXX. 1019 (1864)[1]. *Cosmopteryx flavofasciata* E. Wlstn. Ann-Mag. NH. (5 s.). III. 438 (1879)[2]: Lp. St. Helena 53 (1879)[2]. *Cosmopteryx lespedezae* Wlsm. Tr. Am. Ent. Soc. X. 198 (1882)[3]. [? =*Cosmopteryx* (? *gemmiferella* Clms.) Mschl. Ab. Senck. Nat. Ges. XV. 345, 354 (1890)[4]; Wlsm. Pr. Z. Soc. Lond. **1891**. 536, 548 (1892)[5]]. *Cosmopteryx lespedezae* Riley, Smith's List Bor-Am. 107 no. 5771 (1891)[6]. *Gelechia attenuatella* Wlsm. Pr. Z. Soc. Lond. **1891**. 519, 545 (1892)[7]. *Cosmopteryx lespedezae* Wlsm. Pr. Z. Soc. Lond. **1891**. 536, 548 (1892)[8]. *Cosmopteryx flavofasciata* Rbl. Ann. KK. Hofmus. IX. 91–2 (1894)[9]: XI. 133–4, 147 no. 208 Pl. **3**·13 (1896)[10]: XXI. 44 no. 230 (1906)[11]. *Cosmopteryx attenuatella* Wlsm. Pr. Z. Soc. Lond. **1897**. 105–6 no. 123 (1897)[12]. *Cosmopteryx flavofasciata* Stgr-Rbl. Cat. Lp. Pal. II. 185 no. 3553 (1901)[13]. *Cosmopteryx lespediza* Dyar Pr. Ent. Soc. Wash. IV. 478 (1901)[14]. *Cosmopteryx attenuatella* Dyar Bull. US. Nat. Mus. **52**. 535 no. 6068 (1902)[15]; Busck Pr. US. Nat. Mus. XXX. 710 (1906)[16].

Hab. UNITED STATES[3, 6, 12, 15–16]—TEXAS[8, 12, 16]: ⊕ *Lespedeza*[3, 8, 12]—N. CAROLINA[8, 12]—FLORIDA[14–16]: II–III[14]. WEST INDIES[1, 4–5, 7–8, 12, 16] — JAMAICA[1, 7, 12]: Constant Springs, 18.

XII – 2. I. 1905 (*Wlsm.*); Runaway Bay, 17. II – 13. III. 1905 (*Wlsm.*)—HAYTI [12, 16]: V [12]; San Domingo [16]—[? PORTORICO [4–5, 12]] —ST. CROIX: V [12]—ST. VINCENT [7, 12]—GRENADA: III–IV [12]—**St. Helena** [2, 9, 13]. **Canaries** [10–11, 13] — TENERIFE [10–11]: Guimar, 19. III – 12. IV. 1907 (*Wlsm.*); Puerto Orotava, 1895 (*Hedemann*) [10], 29. IV. 1895 (*Hedemann*); 14. V. 1907 (*Wlsm.*) — GRAN CANARIA [10–11]: Las Palmas, 7–9. V. 1895 (*Hedemann*) [10].

Professor Rebel (l. c. **10**) records and discusses *flavofasciata* E. Wlstn., of which I have one of the examples (7244) collected by von Hedemann in the Botanical Gardens at Puerto Orotava, 29. IV. 1895, and six taken by myself at Puerto Orotava, 14. V., and Guimar, 19. III – 12. IV. 1907. I have now re-examined Mrs. Wollaston's type from St. Helena, and am convinced that it is the same as the species identified by Rebel under this name from Tenerife, but the possession of more specimens has now enabled me to correct the synonymy as follows:—

attenuatella Wkr. (1864); = *flavofasciata* E. Wlstn. (1879); = *lespedezae* Wlsm. (1882)—thus proving that the species is widely distributed.

77. (3555) COSMOPTERYX TURBIDELLA Rbl.

Cosmopteryx sp. Rbl. Ann. KK. Hofmus. IX. 18, 91–2 no. 183 (1894) [1]. *Cosmopteryx turbidella* Rbl. Ann. KK. Hofmus. XI. 135–6, 147 no. 209. Pl. **3** · 14 ♀ (1896) [2]: XXI. 44 no. 231 1906 [3]: Stgr-Rbl. Cat. Lp. Pal. II. 185 no. 3555 (1901 [4].

Hab. **Canaries** [1–4]—TENERIFE [1–4]: Guimar, 5. II – 17. III. 1907 (*Wlsm.*), 20. III. 1904 (*Eaton*), ⊕ *Parietaria vulgaris*, 5. II, excl. 17–18. III. 1907 (*Wlsm.*); Puerto Orotava, ⊕ *Parietaria*, excl. 15–25. III. 1904 (*Eaton*), 16–30. IV. 1895 (*Hedemann*) [2]; Forest de la Mina, 17. III. 1902 (*Eaton*); Cruz de Afur, 5. IV. 1904 (*Eaton*); Las Mercedes, 28. V. 1907 (*Wlsm.*), VI. (*Cabrera*) [1]; Barranco del Loro (nr. Realejo Alto), ⊕ *Parietaria arborea*, 7. V, excl. 11–12. VI. 1907 (*Wlsm.*).

Cosmopteryx turbidella feeds on *Parietaria vulgaris*, near Guimar, in great abundance; it was found there by Mr. Eaton, who also observed the larvae where I have taken and bred it. An intimate acquaintance with the form of the mine caused me to suspect that a large, broad-leaved, shrub growing in the Barranco del Loro, above Realejo Alto, was *Parietaria arborea*; and this turned out to be correct.

C. turbidella Rbl. differs from *pulcherrimella* Chmb. in the possession of a black dot, a little above the middle of the wing, contiguous to the golden metallic band which precedes the yellow fascia; also in having the silver apical streak undivided, whereas in *pulcherrimella* it is broken into two short lines; moreover, the outer golden fascia does not commence in a pure white costal spot, as in the somewhat smaller American species. After reexamining my series of *pulcherrimella*, collected in Madeira by Wollaston, with the addition of specimens subsequently received from Eaton, and my own from Tenerife, I am surprised to find that there is not a specimen of *turbidella* from Madeira. Mr. Eaton notes (MS., 16. IV. 1904) that "The *Cosmopteryx* so common at Guimar, and Puerto (de la Cruz) Orotava [i. e. *turbidella* Rbl.], was also plentiful on *Parietaria*, at Funchal, in the garden of the Carmo Hotel"; but his specimens of *pulcherrimella* were taken at "Funchal: at altitude of about 600 ft., 26. II. 1902: out of *Eupatorium adenophorum* Spreng.," one of the *Compositae*. This plant should be searched, but it is not a probable food-plant for *pulcherrimella* Chmb., which in the United States feeds on *Pilea pumila*, one of the *Urticaceae*.

Cosmopteryx turbidella is by no means consistent in the colour of the yellow fascia; this, in some specimens, is almost obsolete through the strength of the brownish suffusion; in others the colour is only slightly influenced in tone, while rarely it is of a clear orange-yellow, without partial shading or suffusion. I have again carefully compared all the specimens, without being able to detect any difference between the American and Madeiran specimens of *pulcherrimella*.

37. (405) STAGMATOPHORA HS.

78. (3564) STAGMATOPHORA (PYRODERCES) ARGYROGRAMMOS Z.

Cosmopteryx argyrogrammos Z. Isis **1847**. 37–8 no. 177[1]. *Pyroderces argyrogrammos* Cnst. Ann. Soc. Ent. Fr. LII. 20 (1883)[2]; Rbl. Ann. KK. Hofmus. XI. 132, 147 no. 207 (1896)[3]: XXI. 44 no. 233 (1906)[4]: Stgr-Rbl. Cat. Lp. Pal. II. 185 no. 3564 (1901)[4].

Hab. WC. ASIA[1, 5]—HALEB: Shar Devesy, 1893 (*Nat. Coll.*: *Leech*). S-MC. EUROPE[1–5]—ITALY: Rome, 10–25. IV. 1893 (*Wlsm.*)—CORSICA: Corté, 19–21. V. 1896; Ile Rousse, 5. VI. 1898; Ajaccio, 16. VI. 1899 (*Wlsm.*)—FRANCE: ⊕ Compositae —*Carlina corymbosa*, *Kentrophyllum lanatum*, *Centaurea aspera*, *Pycnomon acarna*, *etc.*[2]; Monte Carlo, 5. V. 1882 (*Wlsm.*); Beaulieu, ⊕ *Carduus*, excl. 12. VII. 1889 (*Wlsm.*) — S. SPAIN: MALAGA: Malaga, 14. III. 1901: GRANADA: Granada, 22. V – 20. VI. 1901: CADIZ: Chiclana, ⊕ *Centaurea*, excl. 10. VI. 1902 (*Wlsm.*). N. AFRICA[5]—ALGERIA: Bône, 21. IV. 1896 (*Eaton*)—MOROCCO: Tangier, IV. 1902 (*Wlsm.*); Rabat, IV. 1902 (*Wlsm.*). **Canaries**[3–4]—TENERIFE[3–4]: Guimar, III^{e}. 1907 (*White*); Puerto Orotava, 14. IV. 1895 (*Hedemann*)[3]; La Laguna, 5. VI. 1907 (*Wlsm.*).

Mr. White took a good specimen of this at Guimar, when collecting with me, at the end of March; I subsequently met with a worn example, at La Laguna, in June.

38. (417) APHELOSETIA Stph.

=**Elachista* (Tr. p.) Z., Stn., Stgr-Rbl., etc.

Type *Phalaena Tinea argentella* Cl. (Wstwd. 1840).

Aphelosetia Stph. Ill. Br. Ent. Haust. IV. 287 (1834); Wstwd. Syn. Gn. Br. Ins. 112–3 (1840).
Elachista Tr. (c. Elachista) Z. Isis **1839**. 211, 212–3.

When describing *Elachista*, Treitschke [Schm. Eur. IX. (2). 177 (1833)] wrote as part of his generic diagnosis: "Die Raupen leben auf der Unterseite der Baumblätter oder minirend zwischen den Häuten derselben. Sie verpuppen sich in festen Hülsen." This restricted the possible type to species with such larval habits (i. e. *Bucculatrix* Z. and *Phyllonorycter* Hb.) with whose life-history Treitschke was acquainted, and rendered it impossible for any of the grass-mining species (*Elachista* Auct.) to be regarded as a potential type. Treitschke quotes the life-history of *Bucculatrix frangulella* Göze and *Phyllonorycter* (*Lithocolletis*) *tremulae* Z. from Fischer von Röslerstamm (*in litt.*), but he was personally acquainted with the larvae of *ulmifoliella* Hb. and *blancardella* (F., *mespilella* Hb. 272) Tr. *Elachista* Tr. must therefore sink as a synonym of *Phyllonorycter* Hb., and *ulmifoliella* Hb. should be taken as the type. Duponchel [HN. Lp. Fr. XI. 25, 499–502 no. 30 (1836)] cited *complanella* Hb. as the type of *Elachista* Tr., but Treitschke was unacquainted with the larva of *complanella*, and this species is not indicated as specially typical. Zeller's restriction to the grass-feeding species is also invalid for the same reason.

79. (3994·1) Aphelosetia hypoleuca, sp. n.
(Plate LII. fig. 11.)

Antennae fuscous, the basal joint pale ochreous. *Palpi* whitish ochreous. *Head* and *Thorax* whitish ochreous, the latter faintly shaded with fawn-grey. *Forewings* pale ochreous (whitish ochreous if worn), sprinkled and suffused with fawn-brown, especially above the fold beyond the middle, with some deeper brownish fuscous shades, notably along the costa and about the tornus; three black spots, one below the costa at two-thirds; a smaller one, a little beyond and below it, about the end of the cell; a third, more conspicuous, on the fold at about half the wing-length; a strong blackish shade-line runs along the middle of the brownish ochreous cilia. *Exp. al.* 8–9·5 mm. *Hindwings* rather dark leaden grey; cilia tawny greyish. *Abdomen* grey, anal tuft ochreous. *Legs* pale brownish ochreous, shaded with fuscous externally.

Type ♂ (99036); ♀ (14312) Mus. Wlsm.

Hab. Tenerife: Forest de la Mina, 17. III. 1902, 7. IV. 1904 (*Eaton*); Realejo, 7–10. V. 1907 (*Wlsm.*); Puerto Orotava,

14. V. 1907 (*Wlsm.*); La Laguna, 23. V. 1907 (*Wlsm.*); Las Mercedes, 29. V. 1907 (*Wlsm.*). Nineteen specimens.

Not uncommon, on the higher ground, in the barranco above Realejo and elsewhere; first taken by Mr. Eaton, in the forest of La Mina. It is very near to *albidella* Tngstr. (1847; =*rhynchosporella* Stn., 1848), but differs in the possession of two extra spots beyond the conspicuous plical one: the European species having no spot at the end of the cell or below the costa. Vein 5 is absent in both wings.

39. (417·01) POLYMETIS, gn. n.

(πολύμητις=of-many-counsels.)

Type *Polymetis carlinella* Wlsm.

Antennae $\frac{3}{4}$, slightly serrate towards apex; basal joint with strong pecten. *Maxillary Palpi* short. *Labial Palpi* smooth, usually dependent, but capable of upward movement; terminal joint shorter than median, rather obtusely pointed. *Haustellum* small. *Head* and face coarsely, almost roughly, scaled. *Thorax* smooth. *Forewings* evenly lanceolate: *neuration* 12 veins; 7 and 8 stalked, 7 to costa; 6 out of 7, to termen; 5 out of stalk of (6+7+8); rest remote, 3 slightly approximate to 4; 1^c distinct, 1 furcate at base. *Hindwings* nearly $\frac{2}{3}$, tapering evenly to an acute apex; cilia 2–2$\frac{1}{2}$: *neuration* 7 veins, 5 and 4 coincident; 6 and 7 stalked, enclosing apex; 2 remote from 3, which is somewhat approximate to (4+5); above 5 the discoidal recedes to radius. *Abdomen* smooth. *Legs*, hind tibiae hairy.

Almost corresponding in neuration with some species of *Aphelosetia* Steph. and *Stagmatophora* HS.; separated from the former by the basal furcation of vein 1 of the forewings, as well as by the shorter and less recurved palpi, and from the latter by the same characters, and by the coincidence of veins 5 and 4 of the hindwings. The habits of the larva afford additional reason for separating *Polymetis* from *Aphelosetia* (*Elachista* Auct.), of which the larvae of all known species feed on the *Gramineae*, or *Cyperaceae*.

80. (3920·1) Polymetis carlinella, sp. n.
(Plate LII. fig. 13.)

Antennae and *Palpi* whitish cinereous. *Head* white. *Thorax* whitish cinereous. *Forewings* white, profusely and evenly dusted throughout with pale greyish brown scales; the outer half of the cilia whitish cinereous. *Exp. al.* 10–11 mm. *Hindwings* grey; cilia pale brownish cinereous. *Abdomen* greyish. *Legs* whitish, with faint greyish shade-bands on their outer sides.

Type ♂ (99037); ♀ (99038) Mus. Wlsm.

Hab. Tenerife—Tacaronte, and Guimar, ⊕ **sup.** *Carlina salicifolia*, 19. II – III, excl. 13. III – 23. IV. 1907; Puerto Orotava, 27. IV. 1907. Eight specimens.

The larva feeds in mines, reminding one of those of the bramble-feeding *Tischeria marginea* Hw. on the upper surface of leaves of *Carlina salicifolia*. I found it near Tacaronte, at Guimar, and near Orotava—seven specimens were bred and one captured.

40. (274·1) MENDESIA Joannis.

MENDESIA Joann. Bull. Soc. Ent. Fr. LXXI: **1902**. 230–1 (1902); Mendes Brotéria III. 249–51 (1904).

81. (2343·2) MENDESIA SYMPHYTELLA, sp. n. (Plate LII. fig. 14.)

Antennae brownish fuscous; basal joint white, with strong pecten. *Palpi* slightly recurved, white; terminal joint less clothed, and therefore apparently rather more slender than median. *Head* coarsely scaled above; white. *Thorax* smooth, white. *Forewings* white, sparsely dusted with brownish scales; a brown spot in the fold at about half the wing-length, and another at the end of the cell; a brown streak along the termen, running out through the white apical cilia; cilia white, very sparsely dusted with brown along their base. *Exp. al.* 12–14 mm. *Hindwings* of the ♂ white; of the ♀ inclining to greyish; cilia of both sexes yellowish white. *Abdomen* greyish fuscous, except along the margins of the segments. *Legs* white; hind tibiae with long white hairs.

Type ♀ (99045); ♂ (99046) Mus. Wlsm.

Hab. TENERIFE: Santa Cruz, 12. I – 10. II. 1907, ⊕ *Symphytum sp.*, 7–25. I, excl. 25. I – 20. II. 1907 (*Wlsm.*); Forest de la Mina, 17. III. 1902 (*Eaton*); Guimar, 19. III – 10. IV. 1907 (*Wlsm.*); La Laguna, 1–6. IV. 1904 (*Eaton*). Thirty-three specimens.

Twelve specimens were bred from larvae, found at Guimar, mining leaves of *Symphytum*; the mine almost undistinguishable from that of *Acrocercops scalariella* Z., but the pupa enveloped in a white, silken, rather flat, ovate cocoon. Mr. Eaton caught a single specimen of this species in the Forest de la Mina, in 1902; in 1904 he met with it again, at La Laguna, and I took it on the wing at Santa Cruz and Guimar.

41. (415) PERITTIA Stn.

82. (3919·2) PERITTIA CEDRONELLAE, sp. n. (Plate LII. fig. 12.)

Antennae tawny fuscous above, pale cinereous beneath; a pale spot at the outer end of the short, and rather thickened, basal joint. *Palpi* slender, drooping; tawny fuscous. *Head* dull yellowish white, the face shaded with fuscous. *Thorax* tawny fuscous. *Forewings* tawny fuscous, with some faint pale sprinkling; an oblique yellowish white dorsal streak, arising at about one-fourth, extends across the fold to the cell; beyond the middle of the dorsum is another, yellowish white, upright streak, broad at its base, slightly inverted, and attenuate to its apex on the cell; this is succeeded by an ill-defined, and much diffused, streak along the termen; a dark fuscous line runs through the tawny greyish cilia, falsely indicating a tornus, more defined than in the wing itself. *Exp. al.* 6·5–7 mm. *Hindwings* dark grey; cilia tawny greyish. *Abdomen* greyish fuscous. *Legs* yellowish white, broadly banded on tibiae and tarsi with dark tawny fuscous.

Type ♂ (99047); ♀ (99048) Mus. Wlsm.

Hab. TENERIFE: Santa Cruz, 3000 ft., ⊕ *Cedronella triphylla*, 3. I, excl. 24. I – 1. II. 1907 (*Wlsm.*); Puerto Orotava, 10. III. 1904 (*Eaton*); Cruz de Afur, 10. III. 1904 (*Eaton*). Fifteen specimens.

The larva feeds, in December and January, in a broad blotch-mine, on leaves of *Cedronella triphylla*, and is abundant at the head of the Barranco del Bufadero, near Santa Cruz, and probably on all the high ground, where this plant occurs, along the outskirts of the forests of *Erica arborea*. Mr. Eaton met with the species near the same locality, in 1904, and also in the Barranco Martianez, Puerto Orotava.

The Tenerife species of *Perittia*, here described, have the palpi slightly longer than those of *obscurepunctella* Stn., but this slight difference is not of generic value.

83. (3919·3) PERITTIA LAVANDULAE, sp. n.

Antennae fuscous. *Palpi* fuscous, tipped with whitish. *Head* hoary whitish, with fuscous speckling. *Thorax* fuscous, with some whitish scales on the tegulae. *Forewings* dark fuscous, profusely sprinkled with rather yellowish white scales, by concentration of which the dorsal streak arises at one-fourth, pointing outward, and diffused upward to the costa; a larger, upright, streak arises before the tornus and extends nearly to the costa, a further patch spreading over the upper half of the termen and apex; a line of dark fuscous scales runs through the greyish fuscous cilia. *Exp. al.* 4·5–6 mm. *Hindwings* and cilia greyish fuscous. *Abdomen* dark fuscous. *Legs* whitish, broadly banded with dark tawny fuscous on the tibiae and tarsi.

Type ♂ (99071); ♀ (99072) Mus. Wlsm.

Hab. TENERIFE: Santa Cruz, 14. I – 21. II. 1907, ⊕ *Lavandula abrotanoides*, 20. I – 22. II, excl. 13. II – 28. III. 1907; Guimar, 28. II. 1907; La Laguna, ⊕ *Lavandula staechas*, 3. VI, excl. 19. VII. 1907. Thirty-six specimens.

The larva is common, at Santa Cruz, on *Lavandula abrotanoides*, hollowing out the ends of the slender leaflets, and leaving them bleached, when passing from one to another (after the manner of the larvae of *Epermenia* on *Umbelliferae*); it also feeds on *Lavandula staechas*.

It is extremely difficult to describe the differences between this species and *cedronellae*: its smaller size, more sprinkled appearance, and slightly yellower-white markings may alone be relied on to separate them.

I have, what I believe to be, yet a third, intermediate, species of *Perittia*, (**bystropogonis**), from Guimar, feeding on *Bystropogon plumosus*, in March, and emerging towards the end of April.

Hab. TENERIFE: Guimar, ⊕ *Bystropogon plumosus*, 27. III, excl. 21–26. IV. 1907. Six specimens (99076–81).

---

42. (384) SCYTHRIS Hb.

84. (3478·02) SCYTHRIS ARACHNODES, sp. n. (Plate LII. fig. 16.)

Antennae black. *Palpi* slender, porrect; hoary greyish, mixed with black. *Head* and *Thorax* black; face greyish. *Forewings* short, obtusely lanceolate; black, a few greyish white scales at the base, and two transverse bands of the same, one before, the other beyond the middle; the first narrower than the second, and running a little obliquely outward from the costa; the second moderately straight, both being ill-defined, with a few scattered whitish scales between them, others forming a patch at the apex; cilia greyish fuscous. *Exp. al.* 7–10 mm. *Hindwings* dark leaden grey; cilia greyish fuscous. *Abdomen* steely grey. *Legs* greyish fuscous, the tarsi shaded with black.

Type ♂ (99082); ♀ (99083); ⊕ (99084) Mus. Wlsm.

Hab. TENERIFE: Santa Cruz, 12–20. II. 1907 (*Wlsm.*), 4. IV. 1904 (*Eaton*), ⊕ in webs on rocks, 6. I, excl. 15. II – 28. III. 1907 (*Wlsm.*); Cruz de Afur, 5. IV. 1904 (*Eaton*); Guimar, ⊕ in webs on rocks, 1. III – 4. IV, excl. 11. VIII. 1907 (*Wlsm.*). Twenty-seven specimens.

The larva feeds, probably on small lichens, on the surface of rocks, and rough stones in walls, and is very widely distributed in the Island, where its webs are to be seen forming numerous small patches on the face of almost every rock by the roadside. They have the appearance of rather opaque spiders' webs, and as they endure long after the moth has left them they are much more numerous than the larvae themselves. Nearly allied to *bubaniae* Wlsm. [Ent. Mo. Mag. XLI. 6–7 no. 3478·1 (1907)], but smaller, and the fasciae are much more distinct.

85. (3533·1) SCYTHRIS PETRELLA, sp. n. (Plate LII. fig. 17.)

Antennae greyish fuscous. *Palpi* slender, porrect; ash-grey. *Head* and *Thorax* ashy grey. *Forewings* greyish fuscous, mottled with ashy white, the base sprinkled with ashy white scales; an outwardly angulate, ill-defined fascia at two-fifths, followed by more sprinkled scales, especially towards the costa, the whole outer third of the wing mottled with the same, a spot at the end of the cell, a costal patch before the apex, and a streak along the termen being of the plain dark ground-colour; cilia ashy greyish. *Exp. al.* 8–9 mm. *Hindwings* grey; cilia brownish grey. *Abdomen* fuscous. *Legs* pale ashy grey.

Type ♂ (99085) ♀ (99086) Mus. Wlsm.

Hab. TENERIFE: Puerto Orotava, 23–30. IV. 1907; Las Mercedes, 29. V. 1907; La Laguna, 5. VI. 1907. Twelve specimens.

The distribution of the ashy white scaling varies considerably, and in some specimens occupies a much larger proportion of the wing-surface than in others. It appears to be more variable than the larger, and perhaps allied, *cicadella* Z., and is paler and less uniform in its ill-defined marking than *arachnodes*.

86. (3536) SCYTHRIS FASCIATELLA Rgt. (Plate LII. fig. 15.)

=**roscidella* Rbl. (nec Z.).

Butalis fasciatella Rgt. Bull. Soc. Ent. Fr. XLIX. (5 s. X: **1880**). pp. cxxi–ii (1881)[1]. **Blastobasis* **roscidella* Rbl. Ann. KK. Hofmus. IX. 18, 90 no. 177 (1894)[2]: XXI. 44 no. 219 (1906)[3]. *Butalis fasciatella* Sbld. Deutsche Ent. Zts. Iris XI. 319 (1898)[4]. *Scythris fasciatella* Stgr-Rbl. Cat. Lp. Pal. II. 183 no. 3536 (1901)[5].

Antennae cinereous beneath, fuscous above. *Palpi* whitish cinereous. *Head* and *Thorax* pale cinereous, a brownish band crossing the latter, including the outer part of the tegulae. *Forewings* hoary whitish, dusted with fuscous and pale rust-brown scales; a much sprinkled basal patch, extending to one-third, is obliquely margined outwardly by a band of the pale ground-colour, the sprinkling being condensed in a small costal spot near the base, and in a costal shade a little beyond this—both accompanied by rust-brown; an oblique fuscous fascia, about the middle, is shaded with rust-brown along its ill-defined outer side and on the costa, the paler apical area beyond it much sprinkled and mottled with the same colours, in which a fuscous, condensed, spot above the tornus is distinguishable; cilia greyish fuscous, with some hoary scales. *Exp. al.* 10·5–11 mm. *Hindwings* brownish grey; cilia pale greyish fuscous. *Legs* hoary whitish, the hind tibiae with two greyish fuscous bands across their outer sides; the hind tarsi also suffused with fuscous externally.

CT. ♂ (99087); ♀ (99088); ⊕ (99089) Mus. Wlsm.

Larva brownish grey; head pale brownish; a pale, ill-defined, dorsal line, interrupted by brownish fuscous spots on each of the abdominal somites; all the somites laterally shaded with brownish fuscous, and stippled with minute pale ocellated dots; underside, up to the spiracular line, pale whitish ochreous; thoracic legs dotted with fuscous. *Long.* 12 mm.

Hab. SPAIN[1, 4–5]: VALENCIA: Alicante, ⊕ . . . ? . . . , excl. 15. XI. 1879 (*Rgt.*)[1]: ANDALUSIA[4–5]: III[4]. **Canaries**[2–3]—TENERIFE: IV. 1885 (*Leech*)[2]; Puerto Orotava, 26. IV – 10. V. 1907 (*Wlsm.*),

⊕ *Salsola oppositifolia*, 27. IV, excl. 19. V – 2. VI. 1907 (*Wlsm.*), ⊕ *Atriplex parvifolius*, 10. V, excl. 3. VI. 1907 (*Wlsm.*).

When describing *fasciatella*, Ragonot states that he took and bred several specimens, but omits to mention the food-plant. I found this species on the wing, and the larva feeding among shoots of *Salsola oppositifolia*, and on *Atriplex parvifolius* in a slight web, in April and May; the moths emerged in May and June. This is the species wrongly identified by Rebel as "*Blastobasis roscidella* Z.", which, apart from the generic differences, it does not greatly resemble. I fear the specimen I sent him must have been a very poor one. The type of *Blastobasis roscidella* is in the Zeller Collection, and I have also a Cotype of *Butalis fasciatella* received from the late M. E. Ragonot.

43. (383) EPERMENIA Hb.

87. (3413) EPERMENIA DAUCELLA Peyr.

Chauliodus daucellus Peyr. Pet. Nouv. Ent. I. 57–8 (1870)[1]; Hrtm. MT. Münch. Ent. Ver. IV. 44 no. 2564 (1880)[2]; Wlsm. Ent. Mo. Mag. XXVII. 147 (1891)[3]: Tr. Ent. Soc. Lond. **1894**. 538, 554 no. 59 (1894)[4]. *Epermenia daucella* Stgr-Rbl. Cat. Lp. Pal. II. 179 no. 3413 (1901)[5].

Hab. S. EUROPE: *Daucus carota*[1-2]; *Thapsia villosa*[3]—GIBRALTAR, ⊕ *Thapsia*, III, excl. 7. IV – 21. V. 1901 (*Wlsm.*). N. AFRICA — MOROCCO: Tangier, 30. I. 1902 (*Wlsm.*). **Madeiras**[4]—MADEIRA[4]: (*Wollaston*)[4]. **Canaries**—TENERIFE: La Laguna, 31. V. 1907 (*Wlsm.*).

A single specimen occurred at La Laguna, at the end of May: this species had already been recorded by me from Madeira, but had not been observed in Tenerife.

44. (283) PRAYS Hb.

88. (2382) PRAYS CITRI Mill.

Acrolepia citri Mill. Pet. Nouv. Ent. I. 310 (1873)[1]. *Prays citri* Stgr-Rbl. Cat. Lp. Pal. II. 133 no. 2382 (1901)[2]: Rbl. Ann. KK. Hofmus. XXI. 38, 44 no. 206 (1906)[3].

Hab. CORSICA[1-3]—SICILY[1-3]—S. FRANCE[3]: ⊕ *Citrus decumana*[3]. **Canaries**[3]—TENERIFE[3]: Guimar, 1896 (*White*)[3]; Puerto Orotava, 10. III. 1904 (*Eaton*).

Mr. Eaton took a single specimen, at light in the hotel, in March 1904: I did not myself meet with this species.

45. (281) HYPONOMEUTA Ltr.

89. (2361) HYPONOMEUTA GIGAS Rbl.

Hyponomeuta gigas Rbl. Ann. KK. Hofmus. VII. 271–2, 283 no. 52, Pl. **17** · 17 ♂ (1892)[1]: IX. 18, 89 no. 166 (1894)[2]: XI.

126–7, 146 no. 185 (1896)[3]: XIII. 377, 381 no. 199 (1898)[4]. *Yponomeuta gigas* Rbl. Ann. KK. Hofmus. XXI. 44 no. 205 (1906)[5]: Stgr-Rbl. Cat. Lp. Pal. II. 132 no. 2361 (1901)[6].

Hab. **Canaries**[1–6]—TENERIFE[2–6]: Realejo, ⊕ *Salix canariensis*, 25. IV, excl. V – VI. 1895 (*Hedemann*)[3], ⊕ 25. IV – 7. V, excl. 10. V – 2. VI. 1907 (*Wlsm.*); La Laguna, ⊕ *Populus alba*, 21. V, excl. 30. V. 1907 (*Wlsm.*); Santa Cruz, 1. VI. 1889 (*Krauss*)[2]—GRAN CANARIA[1–6]: 1890 (*Richter*)[1]; ⊕ *Salix*, *Populus*, *Ocotea* (*Oreodaphne*) *foetens*, excl. 29. IV – 25. V. 1893 (*Lowe*); nr. Teror, ⊕ *Populus*, excl. 10. V. 1895 (*Hedemann*)[3]; Santa Brigida, ⊕ *Salix canariensis*, excl. IV[e] – V[b]. 1898 (*Hintz*)[4].

Many years ago I received a considerable number of larvae of this species from Dr. John Lowe, who wrote as follows:—

"The larvae occur in countless myriads on the Willow, Poplar, and 'Till' trees (Laurel: *Oreodaphne foetens*). They spin a fine silken web over the entire tree, even to its ultimate branches, which makes them look white and silvery. The underwood and stones at the base are also covered with the silk tissue, which is so closely woven that there are no visible openings. I was able to strip off pieces five or six feet in length." . . . . . "It is just possible that there may be more than one species, but I am doubtful about this. If it is so one will be found in the box, with a pin through it, which I took from *Salix*—the rest were from *Oreodaphne*. I am sending you some of the silk, which is most remarkable. The brushwood under the trees was completely covered by it, also the grasses and large stones. The tree-trunks were so closely covered that one could not see even a pinhole on the smooth trunks of the 'Till'—every branch was covered, and scarcely a leaf remained on any of the infested trees, which were 60 or 70 ft. high. At the base of the trunks the appearance of the web was most singular—large reticulations, like pulmonary cells, seemed to open one into the other, but on closer examination the apparent openings were found to be closed by a membrane of perfect continuity, but so transparent that until something was passed through it one could not perceive that it existed." (Dr. Lowe, *in litt.*, 29. IV., 20. V. 1893.)

I first met with *Hyponomeuta gigas* on three large trees of *Salix canariensis*, at the first branching of the large barranco above Realejo Alto: the ends of the branches were entirely covered with the colonies of larvae, in dense web, having a seriously denuding effect upon the foliage. Subsequently I found it, in less abundance, on *Populus alba*, in the Eucalyptus avenue, running north-east from La Laguna. There is no difference between the specimens reared from *Salix* and *Populus* respectively; the larvae also were undistinguishable. Rebel originally described *gigas* (*l. c.* **1**) as sexually dimorphic, having "alis plumbeis, anterioribus ♂ punctis nigris triseriatis, ♀ innotatis"; subsequently, however, he came to the conclusion that both sexes occurred in both forms, and that the spotless form was characteristic of Gran Canaria, appearing only as an aberration in Tenerife. It may be convenient to name the spotless form **innotata**, var. n., and then to enumerate in series each variety as represented in my collection.

I have 129 (=*gigas* 93+36 *innotata*) specimens, of which 103 (=*gigas* 91+12 *innotata*) are from Tenerife, and 26 (=*gigas* 2+24 *innotata*) are from Gran Canaria. The series of 103 specimens from Tenerife is composed of 91 (=66 ♂♂+25 ♀♀) *gigas*, of which 55 (=42 ♂♂+13 ♀♀) were bred from *Populus alba*, and 36 (=24 ♂♂+12 ♀♀) were bred from *Salix canariensis*; and 12 (6 ♂♂+6 ♀♀) *innotata*, 8 (=4 ♂♂+4 ♀♀) of which were bred from *Populus* and 4 (=2 ♂♂+2 ♀♀) from *Salix*.

The 26 (=9 ♂♂+17 ♀♀) specimens from Gran Canaria were bred by Dr. Lowe from *Ocotea foetens*; 24 (9 ♂♂+15 ♀♀) are *innotata*, while 2 (♀♀) are *gigas*.

46. (424) PHYLLONORYCTER Hb.

=*LITHOCOLLETIS* Hb.; =EUCESTIS Hb.; =ELACHISTA Tr. (nec *Z.).

(φύλλον=a leaf; ὀρυκτὴρ=a miner.)

Type *Phalaena Tinea rayella* L., Hb. 200.

PHYLLONORYCTER Hb. Tent. p. [2] (1806). LITHOCOLLETIS Hb. Verz. Schm. 423 no. 4117–20 (1826); Stgr-Rbl. Cat. Lp. Pal. II. 210–16 (1901); Dyar Bull. US. Nat. Mus. **52**. 549–57 (1902); Meyr. Pr. Lin. Soc. NSW. XXXII. 49, 51–2 (1907); etc.

Lithocolletis Hb. is a synonym of *Phyllonorycter* Hb., the type of both being *rajella* Hb. Tin. Pl. **29**· 200.

90. (4113) PHYLLONORYCTER HELIANTHEMELLUS HS.

Lithocolletis helianthemella HS. Neue Schm. 20 no. 89, Pl. **18**· 115 (1860)[1]; Stgr-Rbl. Cat. Lp. Pal. II. 211 no. 4113 (1901)[2].

Hab. WC. ASIA[2]. C–S. EUROPE: ⊕ **inf.** *Helianthemum vulgare, guttatum*[1–2]. **Canaries**—TENERIFE: Guimar, 25. II – 10. IV. 1907 (*Wlsm.*).

Taken at Guimar: the larvae observed on *Cistus monspeliensis*.

91. (4165) PHYLLONORYCTER MESSANIELLUS Z.

Lithocolletis messaniella Z. Lin. Ent. I. 221–2 no. 21. Pl. **1**· 23 (1846)[1]; Wlsm. Tr. Ent. Soc. Lond. **1894**. 538, 555 no. 65 (1894)[2]; Stgr-Rbl. Cat. Lp. Pal. II. 214 no. 4165 (1901)[3].

Hab. WC. ASIA[3]. WC-S. EUROPE[1–3]; ⊕ **inf.** *Quercus, Castanea, Carpinus*[3]—ITALY: Rome, 10–25, IV. 1893 (*Wlsm.*)—SPAIN: MALAGA: Malaga, 17. III. 1901 (*Wlsm.*). N. AFRICA—MOROCCO: Tangier, ⊕ **inf.** *Quercus suber*, XII, excl. 25. I – 11. III. 1902 (*Wlsm.*). **Madeiras**[2]—MADEIRA[2]: (*Wollaston*)[2]. **Canaries**—TENERIFE: La Laguna, ⊕ **inf.** *Quercus suber*, 13. I, excl. 17–30. I. 1907 (*Wlsm.*), 14. III. 1902 (*Eaton*), ⊕ **inf.** *Quercus sp.* (*decid.*), 23. V, excl. 4. VI. 1907 (*Wlsm.*); Guimar, 25. II. 1907 (*Wlsm.*).

First received from Mr. Eaton: I found it in great abundance at La Laguna and Guimar, on *Quercus suber*—also on a deciduous oak at the former place.

92. (4166) PHYLLONORYCTER PLATANI Stgr.

Lithocolletis platani Stgr. Hor. Soc. Ent. Ross. VII. 277–9, Pl. **3** · 18 (1870)[1]; Stgr-Rbl. Cat. Lp. Pal. II. 214. no. 4166 (1901)[2].

Hab. WC. ASIA[2]. S. EUROPE: ⊕ **inf.** *Platanus orientalis*[1-2]—SPAIN: MALAGA: Malaga, 17. III. 1901 (*Wlsm.*). **Canaries**—TENERIFE: Santa Cruz, 8. I – 11. II. 1907, ⊕ **inf.** *Platanus orientalis*, 1. I, excl. 14–20. II. 1907 (*Wlsm.*).

Extremely abundant at Santa Cruz: the fallen leaves were crowded with mines at Xmas, 1906.

93. (4180) PHYLLONORYCTER CYTISELLLUS Rbl.

Lithocolletis cytisella Rbl. Ann. KK. Hofmus. XI. 140–1, 147 no. 217. Pl. **3** · 17–17a (1896)[1]: XXI. 44 no. 242 (1906)[2]: Stgr-Rbl. Cat. Lp. Pal. II. 215 no. 4180 (1901)[3].

Hab. TENERIFE[1-3]: La Laguna, ⊕ *Cytisus proliferus*, 13. I, excl. 16. I – 8. II. 1907 (*Wlsm.*); Guimar, ⊕ *Cytisus proliferus*, 26. II, excl. 3–25. III. 1907, 7. IV. 1907 (*Wlsm.*); Puerto Orotava, 11–26. IV. 1895 (*Hedemann*)[1], 9. V. 1907 (*Wlsm.*); Las Mercedes, 29. V. 1907 (*Wlsm.*).

Common: a long series taken among, and bred from, *Cytisus proliferus*. It is very variable, some forms approaching *juncei*.

94. (4180·1) PHYLLONORYCTER JUNCEI, sp. n.

Antennae and *Palpi* white. *Head* white, mixed with golden brownish. *Thorax* golden brownish, with white streaks at the sides, and posteriorly. *Forewings* shining, golden brown, with five costal, and two dorsal, white streaks, more or less plainly indicated; the first costal is at about half the wing-length, and further removed from the second than the others are from each other; the first dorsal is larger than the first costal, commencing before it, but approaching it at its apex; the second dorsal is opposite to the second costal; there is also a white basal streak, sometimes produced as far as the first pair, and partially connected with a small white dorsal streak; the outer half of the wing is thickly studded with black scales, which tend to form dark inner margins to the first and second costal, and to the second dorsal streaks, also an outer margin to the inverted costal streak before the apex; there is a conspicuous, elongate patch of similar black scales, also before the middle, forming an inner margin to the first dorsal streak; terminal cilia golden brown at their base, with a dark line dividing this from their paler outer ends. *Exp. al.* 7·5–9 mm. *Hindwings* pale grey; cilia pale brownish grey. *Abdomen* greyish. *Legs* white.

Type ♀ (99090); ♂ (99091) Mus. Wlsm.

Hab. Tenerife: Villa Orotava, 6. V. 1907; Puerto Orotava, ⊕ *Genista stenopetala*, 8. V, excl. 13–16. V. 1907; La Laguna, ⊕ *Spartium junceum*, 21. V, excl. 23. V – 6. VI. 1907. Seventy-eight specimens.

This is apparently allied to *cytisellus* Rbl., and, like it, is also very variable in the intensity of its markings, which in some specimens are more or less evanescent, but, whereas in *cytisellus* the white so strongly predominates as to overrun the wing and leave golden markings, in *juncei* the golden ground predominates, leaving white markings. I have a long series of bred specimens of both species, and can never be at a loss to distinguish them.

I first found *juncei* in the garden behind the Hotel Vittoria, Villa Orotava, flying freely about *Genista stenopetala*, and afterwards bred it from leaves of the same, gathered at Puerto Orotava; but it was even more abundant on *Spartium junceum*, by the side of the road from La Laguna to Tegeste, where, in one spot only, for about 100 yards, almost every leaf of these plants was affected by the larvae. The species is described from specimens bred from *Spartium junceum*.

95. (4207·1) Phyllonorycter foliolosi, sp. n.
(Plate LIII. fig. 8.)

Antennae white, with blackish annulations. *Palpi* white. *Head* and *Thorax* pale golden brown. *Forewings* pale golden brown, with four costal and three, or four, more obscure, white dorsal streaks; the first two pairs opposite, and frequently appearing as two fasciae by meeting each other, a slender whitish streak sometimes connecting them along the middle; between the white streaklets, as well as towards the base, the wing is plentifully bestrewn with minute black scale-points; cilia mixed golden and whitish, becoming greyish along the dorsum. *Exp. al.* 4–5·5 mm. *Hindwings* and cilia pale grey. *Abdomen* grey, anal tuft ochreous. *Legs* yellowish white.

Type ♂ (99092); ♀ (99093) Mus. Wlsm.

Hab. Tenerife: Guimar, 25. II – 6. III. 1907, ⊕ *Adenocarpus foliolosus*, 26. II, excl. 1–10. III. 1907 (*Wlsm.*); La Laguna, 25. III. 1904 (*Eaton*), 23. V – 9. VI. 1907, ⊕ *Genista canariensis*, 18. V, excl. 5–15. VI. 1907 (*Wlsm.*). Fifty-three specimens.

The larva feeds in the tiny leaflets of *Adenocarpus foliolosus*, at Guimar, at about 2000 ft. above sea-level, sometimes giving to the branches a whitened appearance, through the bleaching of innumerable leaves; I found the same species later, at La Laguna, on *Genista canariensis*, where Mr. Eaton had taken it in March 1904.

The species is allied to *parvifoliellus* Rgt., but differs in the more numerous costal streaks.

47. (420·01) ACROCERCOPS Wlgrn.

n. syn.=CONOPOMORPHA Meyr.; =DIALECTICA Wlsm.

Type 1. *Tinea brongniardella* F. (Wlgrn. 1881).
ACROCERCOPS Wlgrn. Ent. Tdsk. II. 95 (1881).

Type 2. *Conopomorpha cyanospila* Meyr. (Meyr. 1886).
CONOPOMORPHA Meyr. Tr. NZ. Inst. XVIII. 183 (1886): Pr. Lin. Soc. NSW. XXXII. 49, 54–61 no. 4 (1907).

Type 3. *Gracilaria scalariella* Z. (Wlsm. 1897).
DIALECTICA Wlsm. Pr. Z. Soc. Lond. **1897**. 150–1 no. 93.

In his recent paper [Pr. Lin. Soc. NSW. XXXII. 47–68 (1907)] Meyrick has removed the groups of *Gracilaria* and *Zelleria* from the *Tineidae* to the *Plutellidae*, assigning now "more importance to the smooth posterior tibiae which are a normal attribute of those two groups, than to the rough head which is a frequent characteristic. Moreover, whilst folded maxillary palpi are peculiarly characteristic of the *Tineidae*, the simple porrected maxillary palpi of the *Gracilaria* group are so similar to those of the *Plutella* group, and so different from those of any other *Tineina*, that they would seem to indicate real affinity." He concludes from his study of the *Gracilaria* group that "*Coriscium* Z. cannot be maintained as a distinct or natural genus, the scaling of the palpi being subject to much variation, and not according with true affinity. On the other hand," he has "found it practicable to use the scaling of the legs to break up the whole of the species thus thrown together into four groups which are both natural and strictly definable, and since the number of species known is already very large and destined to be much larger," he has "thought it conducive to clearness to establish them as genera." *Cyphosticha* Meyr. and *Conopomorpha* Meyr., having "Posterior tibiae with bristly hairs above," are separated from *Gracilaria* Hw. and *Macarostola* Meyr., with "Posterior tibiae smooth-scaled." *Dialectica* Wlsm. is sunk as a synonym of *Conopomorpha* Meyr.; but *brongniardellum* F. also has "Posterior tibiae bristly above [Meyr. HB. Br. Lp. 749 (1894)], for which reason Wallengren removed it from *Coriscium* Z., making it the type of ACROCERCOPS Wlgn. (1881), described as having "Tibiae postice setosae," and, consequently, *Conopomorpha* must also sink as a synonym.

96. (4082·1) ACROCERCOPS HEDEMANNI Rbl.

Gracilaria hedemanni Rbl. Ann. KK. Hofmus. XI. 136–7, 147 no. 211. Pl. **3**·15 ♂ (1896)[1]: XXI. 44 no. 239 (1906)[2]: Stgr-Rbl. Cat. Lp. Pal. II. 207 no. 4067 (1901)[3].

Hab. **Madeiras**—MADEIRA: The Curralhino, Funchal, 9. IV.

1902 (*Eaton*). **Canaries**[1-3]—TENERIFE[1-3]: Guimar, 2. III. 1907 (*Wlsm.*); La Laguna, 17. III. 1902 (*Eaton*); Forest de la Mina, 2500–2800 ft., 7. IV. 1904 (*Eaton*); Puerto Orotava, 23. IV. 1907, ⊕ *Malva parviflora*, 23. IV, excl. 11-14. V. 1907 (*Wlsm.*); La Matanza, 2. V. 1895 (*Hedemann*)[1]; Las Mercedes, 29. V. 1907 (*Wlsm.*).

The publication of Prof. Rebel's figure of *hedemanni* prevented me from describing a very closely allied species, found at Tangier in 1901. I have now a considerable series of each, and am acquainted with their larvae. Both feed on species of *Malvaceae*, making conspicuous blotches on the upper sides of the leaves, and in both instances the larvae assume, before pupating, the beautiful transverse bands of scarlet, or rich carmine, so well known in *Acrocercops brongniardellum* F.

The Tenerife species is exceedingly common, feeding on *Malva parviflora* everywhere, and on *Lavatera arborea* in gardens, at Orotava and elsewhere. I have received *hedemanni* also from Funchal, Madeira (*Rev. A. E. Eaton*); there is no difference between the Tenerife and Madeira specimens.

(4082·2) ACROCERCOPS MALVACEA, sp. n.

=**hedemanni* Wlsm. (nec Rbl.).

Dialectica sp. n. Wlsm. Ent. Mo. Mag. XXXVII. 236 (1901)[1]. *Gracilaria *hedemanni* Wlsm. Ent. Mo. Mag. XXXIX. 181 (1903)[2].

Hab. MOROCCO: Tangier[1-2], ⊕ *Malva sp.*[1], *Lavatera olbia*[2], ⊕ [*Malva? sp.?*], XII, excl. 1-11. I. 1902, ⊕ 13. IV, excl. 29. IV – 9. V. 1901. Thirty-six specimens. *Type* ♂ (88655); ♀ (88669); ⊕ (88688) Mus. Wlsm.

When recording *Gracilaria hedemanni* from Morocco [Ent. Mo. Mag. XXXIX. 181 (1903)], I was somewhat misled by the absence of a pale basal patch in Rebel's figure. Such a patch is distinctly present in *hedemanni*, but barely traceable or entirely absent from the Tangier insect; moreover the dorsal spot beyond the central fascia is also absent from what I may now call **Acrocercops malvacea**, sp. n. There is also a slight difference in the larvae: in *malvacea* the scarlet transverse bands are shorter, extending less far laterally, and the head is brown—not blackish as in *hedemanni*. I recorded the food-plant as *Lavatera olbia* (Ent. Mo. Mag. XXXIX. 181), but I am unable now to verify this by reference to preserved specimens, which is to be regetted, as I had previously [Ent. Mo. Mag. XXXVII. 236 (1901)] thought the plant "a very large mallow". It was a tall *Malvaceous* plant, sometimes seven or eight feet high, with broad rounded leaves and white, or lilac, flowers.

---

97. (4082·3) ACROCERCOPS SCALARIELLA Z.

Gracilaria scalariella Z. Stett. Ent. Ztg. XI. 160–1 (1850)[1]; Hrtm. MT. Münch. Ent. Ver. IV. 35 no. 2351 (1880)[2]; Wlsm. Tr. Ent. Soc. Lond. **1894**. 538, 555 no. 64 (1894)[3]; Rbl. Ann. KK. Hofmus. IX. 18, 91 no. 181 (1894)[4]: XI. 137, 147 no. 212 (1896)[5]: XXI. 44 no. 240 (1906)[6]. *Dialectica scalariella* Wlsm. Pr. Z. Soc. Lond. **1897**. 150–1 (1897)[7]. *Gracilaria scalariella* Stgr-Rbl. Cat. Lp. Pal. II. 208 no. 4081 (1901)[8].

Hab. WC. ASIA[8]. S. EUROPE[1-8]: ⊕ *Echium vulgare*, X–XI, excl. IV–V[2]—CORSICA: Posso di Borgo, 5. VI. 1889 (*Wlsm.*)

—S. FRANCE[8]: Mentone, ⊕ *Cynoglossum*, excl. 12. III. 1893 (*Wlsm.*); Cannes, ⊕ *Echium*, excl. IV. 1881 (*Wlsm.*); Monte Carlo, ⊕ *Echium*, excl. IV. 1881 (*Wlsm.*)—SPAIN[8]: MALAGA: El-Chorro, ⊕ *Echium*, 5. I, excl. 27. I – 1. II. 1901 (*Wlsm.*); Malaga, ⊕ *Symphytum*, 31. I, excl. 13–14. II. 1901 (*Wlsm.*). N. AFRICA—ALGERIA: Bône, 6–21. IV. 1896 (*Eaton*); Constantine, 26. X. 1895 (*Eaton*)—TUNIS: Tunis, 5. XII. 1893 (*Eaton*). **Madeiras**[3-4, 8]: MADEIRA: (*Wollaston*)[3-4, 8]; Monte, Funchal, 13. IV. 1904 (*Eaton*). **Canaries**[4-8]—TENERIFE[4-6]: IV. 1885 (*Leech*)[4]; Santa Cruz, 1895 (*Hedemann*)[5], 7–12. I. 1907, ⊕ *Symphytum*, 26. XII, excl. 14. I. 1907 (*Wlsm.*); San Andres, ⊕ *Echium spinosum*, 23. I, excl. 26–28. I. 1907 (*Wlsm.*); Puerto Orotava, IV. 1895 (*Hedemann*)[5], ⊕ *Echium sp.*, 8. V, excl. 6. V. 1907 (*Wlsm.*); Realejo, 7. V. 1907 (*Wlsm.*)—GRAN CANARIA: 1895 (*Hedemann*)[5].

This species is common at Santa Cruz, and Guimar, and indeed wherever its food-plants are found. I bred it from at least three different species of *Echium*, as well as from *Symphytum*, in Tenerife, and am able to extend the distribution of the species from captures by Mr. Eaton and myself.

48. (420) GRACILARIA Hw.

98. (4057) GRACILARIA ROSCIPENNELLA Hb.

Tinea roscipennella Hb. Smlg. Eur. Schm. VIII. Pl. **29** · 128 (1796)[1]. *Poeciloptilia roscipennella* Hb. Verz. Schm. 427 no. 4167 (1826)[2]. *Gracilaria roscipennella* Rbl. Ann. KK. Hofmus. VII. 278, 283 no. 62 (1892)[3]: IX. 18, 91 no. 180 (1894)[4]; Wlsm. Tr. Ent. Soc. Lond. **1894**. 538, 555 no. 63 (1894)[5]; Stgr-Rbl. Cat. Lp. Pal. II. 207 no. 4057 (1901)[6]: Rbl. Ann. KK. Hofmus. XXI. 44 no. 237 (1906)[7].

Hab. WC. ASIA. C–S. EUROPE: ⊕ *Juglans*—SPAIN: GRANADA: Sierra Nevada, 3 VI. 1901 (*Wlsm.*). **Madeiras**[5-6]—MADEIRA[5]: San Antonio da Serra (*Wollaston*)[5]; Rabaçal, 3430 ft., 29. IV. 1904 (*Eaton*). **Canaries**[3-7]—TENERIFE[3-7]: IV. 1885 (*Leech*)[4]; La Laguna, ⊕ *Laurus canariensis*, 19. V, excl. 9. VI – 21. VII. 1907 (*Wlsm.*); Taganana, 9. VIII. 1889 (*Simony*)[3].

Prof. Rebel records specimens taken by Professor Simony, above Taganana, among *Woodwardia radicans*; he subsequently recognised a worn specimen, in my own collection (61049), received from the late Mr. J. H. Leech, from Tenerife. I have now succeeded in breeding a few examples from larvae forming conspicuous cones on *Laurus canariensis*, collected in the neighbourhood of La Laguna and Tegeste: after comparing them with a series bred from leaves of *Juglans*, at Cannes, I am quite unable to separate them, but I failed to find any larvae on *Juglans* in Tenerife, although some trees grew at no great distance from the spot where most of my larvae were taken.

99. (4057·1) GRACILARIA STAINTONI Wlstn. (Plate LIII. fig. 14.)

Gracilaria staintoni Wlstn. Ann-Mag. NH. (3 s.). I. 122 (1858)[1]: Wkr. Cat. Lp. BM. XXX. 854 no. 24 (1864)[2]; Wlsm. Tr. Ent. Soc. Lond. **1894**. 538, 555 no. 62 (1894)[3]; Stgr-Rbl. Cat. Lep. Pal. II. 206 no. 4049 (1901)[4].

Antennae pale brownish yellow. *Labial Palpi* white, smeared with tawny reddish on the outer side of the terminal joint, and toward the apex of the median. *Maxillary Palpi* white, tipped with tawny reddish. *Head* pale yellowish brown; face whitish. *Thorax* bright golden yellow above; the tegulae reddish brown. *Forewings* very long and narrow; shining, bright, pale golden yellow, with a purplish lilac suffusion spreading over the dorsal half and becoming rather darker across the apex; at the upper edge of the purplish shade are two or three slight projections of a rather more intense colour, and, on either side of the middle of the costa above them, are one or more minute black dots; cilia reddish purple above the apex, reddish ochreous below it, dark tawny grey along the dorsum. *Exp. al.* 13–14 mm. *Hindwings* shining, leaden grey; cilia tawny grey. *Abdomen* leaden grey, silvery white beneath. *Legs* pale grey, the tarsi fading to whitish, and very faintly spotted.

Type ○ (no. XL) Mus. Br.; *CT.* ♂ (99127); ♀ (14175) Mus. Wlsm.

Hab. **Madeiras**[1-4] — MADEIRA[1-4]: Funchal, 16. IV. 1904 (*Eaton*); The Mount, 1855 (*Wollaston*)[1, 3]. **Canaries**—TENERIFE: Las Mercedes, 30. III. 1904 (*Eaton*); Taganana, 27. V. 1907; Agua Garcia, Tacaronte, 31. V. 1907 (*Wlsm.*); La Laguna, ⊕ *Laurus canariensis*, 19. V, excl. 12. VI. 1907 (*Wlsm.*).

This species was captured at Taganana, and at Agua Garcia, near Tacaronte, and subsequently bred from larvae feeding in large cones on the leaves of *Laurus canariensis*, which were undistinguishable from the cones made by *roscipennella* on the same tree. Mr. Eaton took this species at Funchal, and at Las Mercedes, in 1904.

100. (4057·2) GRACILARIA SCHINELLA, sp. n.
(Plate LIII. fig. 13.)

Antennae pale brownish ochreous, faintly dark-barred above. *Palpi* brownish ochreous, smeared with rust-brown externally. *Head* and *Thorax* brownish ochreous; the tegulae touched with purplish. *Forewings* pale ochreous, suffused with reddish lilac, more strongly at the base of the costa than elsewhere, and notably less on a pale, elongate, mediocostal patch extending to the fold, which, however, like the rest of the wing-surface, is distinctly iridescent; the more suffused portions exhibit every possible variety of iridescence, from purple to green, and cupreous, according to the incidence of light; there is a purplish shade in the cilia below the apex, but the dorsal cilia are pale, iridescent, bronzy greyish. *Exp. al.* 11–14 mm. *Hindwings* $\frac{1}{2}$; pale leaden grey; cilia iridescent, greyish cupreous. *Abdomen* grey, anal tuft ochreous. *Legs* cinereous; the femora and tibiae of the anterior and median pairs thickly clothed with tawny reddish fuscous.

Type ♂ (99130); ♀ (99131) Mus. Wlsm.

Hab. TENERIFE: Santa Cruz, 3. I. 1907, ⊕ *Schinus molle*, 27. XII – 11. I, excl. 22. I – 7. III. 1907. Fifteen specimens.

This species is exceedingly common at Santa Cruz, where the young larva mines the leaflets of *Schinus molle.* It subsequently forms a blister, like that of a *Phyllonorycter*, and eventually rolls a whole leaflet into a compact cone, sometimes pupating within it, but frequently leaving it and forming a smooth, silken cocoon under another leaf. It is remarkable that this species should have escaped observation so long, the tree on which it lives being so commonly introduced in all parts of the south of Europe. It is probably not indigenous in Tenerife, but, if this be the case, it is one of the very rare instances of the introduction of an exotic insect with an imported plant.

101. (4057·3) GRACILARIA AURANTIACA Wlstn. (Plate LIII. fig. 12.)

Gracilaria? aurantiaca Wlstn. Ann-Mag. NH. (3 s.). I. 122 (1858)[1]; Wkr. Cat. Lp. BM. XXX. 854 no. 25 (1864)[2]. *Blastobasis (?) aurantiaca* Wlsm. Tr. Ent. Soc. Lond. **1894**. 538, 552 no. 53 (1894)[3]; Stgr-Rbl. Cat. Lp. Pal. II. 164 no. 3066 (1901)[4]. *Gracilaria sp.* Rbl. Ann. KK. Hofmus. XXI. 39, 44 no. 238 (1906)[5].

Antennae ochreous, faintly barred above with chestnut-brown. *Palpi* ochreous, the median joint chestnut-brown on its outer side. *Head* ochreous. *Thorax* brownish ochreous; tegulae tinged with reddish. *Forewings* rich brownish ochreous, suffused with tawny red toward the apex; with a broad, rich tawny red, triangular patch, commencing at the base of the costa and extending two-thirds the length of the wing, its lower angle slightly crossing the fold before the middle; from the tornus arises an inverted, short, diffused streak of tbe same colour, the cilia also are tawny reddish, except on the costa before the apex, where they are pale cinereous. *Exp. al.* 11–15 mm. *Hindwings* shining, pale grey; cilia pale cinereous. *Abdomen* cinereous. *Legs* pale cinereous, unspotted.

Type ○ (no. XXXIX) Mus. Br.; *CT.* ♂ (99145); ♀ (99146) Mus. Wlsm.

Hab. **Madeiras**[1-4]—MADEIRA[1-3]: 1855 (*Wollaston*)[1-3]. **Canaries**—TENERIFE: 1905 (*White*)[5]: Villa Orotava, 19. II. 1907; Guimar, ⊕ *Hypericum grandifolium*, 19. III, excl. 5–26. IV. 1907 (*Wlsm.*); Cruz de Afur, 5. IV. 1904 (*Eaton*); Arafo, 13. IV. 1907; Puerto Orotava, 23. IV – 10. V. 1907; Realejo, 7. V. 1907; Taganana, 27. V. 1907; Las Mercedes, 31. V. 1907; La Laguna, 3. VI. 1907 (*Wlsm.*).

This species is extremely common in all the barrancos about Guimar, and Villa Orotava, and probably everywhere from 1000–3000 ft. It forms cones on at least two species of *Hypericum* (*grandifolium*, *canariense*, etc.). It is the *Gracilaria sp.*, no. 238 of Rebel's List, and on comparison proves to be the species described as *Gracilaria ? aurantiaca* by Wollaston, from Madeira, which I erroneously listed as *Blastobasis ? aurantiaca* (*l. c.* **3**).

49. (423) BEDELLIA Stn.

102. (4107) Bedellia somnulentella Z.

n. syn. = **daphneella* Wlsm. (nec Stgr.).

Lyonetia somnulentella Z. Isis **1847**. 894–5 no. 432 [1]. *Bedellia somnulentella* Stn. Ann-Mag. NH. (3 s.). III. 214 (1859) [2]; Wlsm. Tr. Ent. Soc. Lond. **1894**. 537, 542 no. 24 (1894) [3]. **Phyllobrostis* **daphneella* Wlsm. Tr. Ent. Soc. Lond. **1894**. 538, 555 no. 66 (1894) [4]. *Bedellia somnulentella* Rbl. Ann. KK. Hofmus. XI. 137, 147 no. 213 (1896) [5]; Busck Pr. US. Nat. Mus. XXIII. 243–4 (1900) [6]; Stgr-Rbl. Cat. Lp. Pal. II. 210 no. 4107 (1901) [7]; Dyar Bull. US. Nat. Mus. **52**. 557 no. 6337 (1902) [8]; Wlsm. Fn. Hawaii. I. 723–4 no. 430. Pl. **25** · 28 (1907) [9].

Hab. C–S. EUROPE [1, 7, 9]: ⊕ *Convolvulus spp.* (*althaeoides*, *arvensis*, *cantabrica*, *mauretanica*, *sepium*) [9], *Ipomoea purpurea* [9]—Spain: malaga: Malaga, ⊕ *Convolvulus althaeoides*, 30. XII, excl. 16. II. 1901 (*Wlsm.*); Torremolinos, 29. I, excl. 3. III. 1901 (*Wlsm.*). N. AFRICA—Algeria: Biskra, 5–12. III. 1903 (*Wlsm.*), 21. IV. 1895, 3. VI. 1893 (*Eaton*); El-Guerrah, 27. V. 1903 (*Wlsm.*). **Madeiras** [2, 5, 7, 9]—Madeira [2–5]: The Mount (*Wollaston*) [4]. **Canaries** [5, 7, 9]—Tenerife [5]: Santa Cruz, ⊕ *Convolvulus althaeoides*, 10. I, excl. 22. I – 10. III. 1907 (*Wlsm.*); Guimar, 2. III. 1907 (*Wlsm.*); Puerto Orotava, 23. IV. 1895 (*Hedemann*) [5]. UNITED STATES [3, 5–9]: ⊕ *Ipomoea*, *Pharbitis* [9]. HAWAIIA [9]. AUSTRALIA [9]. N. ZEALAND [9].

Common on various species of *Convolvulus*: I have recognised the mines on *Convolvulus floridus*, and bred it from *C. althaeoides*.

The record of the occurrence of "*Phyllobrostis daphneella Stgr.*" in the Madeiras [Wlsm. Tr. Ent. Soc. Lond. **1894**. 538, 555 no. 66] must be corrected: examining again the fragment, thus identified at the time, I find it to be a remnant of *Bedellia somnulentella* Z., which Stainton had already recorded from Madeira.

50. (426) TISCHERIA Z.

103. (4210·1) Tischeria tantalella, sp. n.

Antennae pale fawn-ochreous. *Palpi*, *Head*, and *Thorax* pale fawn-ochreous. *Forewings* pale fawn-ochreous, thickly sprinkled with yellowish, and some fawn-brownish, scales, the latter condensed in a narrow streak along the base of the costa, and in a small, but conspicuous tornal spot; cilia brownish grey. *Exp. al.*

8 mm. *Hindwings* pale grey; cilia brownish grey. *Abdomen* grey above, pale yellowish at the sides and beneath. *Legs* shining, fawn-whitish.

Type ♂ (98990) Mus. Wlsm.

Hab. TENERIFE: Guimar, 2. III. 1907. Unique.

The most persistent searching failed to secure a second specimen; there was no oak anywhere near where it occurred. It appears to be more nearly allied to North American than to European species.

104. (4215) TISCHERIA LONGICILIATELLA Rbl.

Tischeria longiciliatella Rbl. Ann. KK. Hofmus. XI. 141–2, 147 no. 218 (1896)[1]: XXI. 44 no. 243 (1906)[2]: Stgr-Rbl. Cat. Lp. Pal. II. 217 no. 4215 (1901)[3].

Hab. TENERIFE[1-3]: Villa Orotava, ⊕ *Rubus fruticosus*, 19. II, excl. 27. II – 22. III. 1907 (*Wlsm.*); Guimar, 28. II – 19. III. 1907, ⊕ *Rubus fruticosus*, 27. II, excl. 17. III – 13. IV. 1907 (*Wlsm.*); Las Mercedes, 2000 ft., 7. III. 1904 (*Eaton*); Forest de la Mina, 7. IV. 1904 (*Eaton*); Puerto Orotava, 15–17. IV. 1895 (*Hedemann*)[1], 3–14. V. 1907 (*Wlsm.*); La Laguna, 8. IV. 1904 (*Eaton*), 9. VI. 1907 (*Wlsm.*).

I have bred this species from *Rubus fruticosus*, amongst which it was found by von Hedemann, and Eaton. Rebel described his type as dark brownish, remarking that his second specimen, which was somewhat worn, had traces of brassy yellow colouring. Some specimens show much more ochreous spotting than the typical form, of which I have several caught and some bred specimens, in which the small yellow dorsal spot before the tornus is almost obsolete; others again, bred and caught, show three strong yellow patches on the outer half of the wing, more or less connected with each other, and another at the base of the costa. The many intermediate gradations clearly prove that these are mere variations of one species.

Tischeria longiciliatella Rbl. must not be confused with the Texan *Tischeria longeciliata* Frey and Boll [Stett. Ent. Ztg. XXXIX. 259 (1878), ⊕ *Helianthus*], which Prof. Rebel probably overlooked when naming the Tenerife species.

51. (446) ACROLEPIA Crt.

105. (4478) ACROLEPIA VESPERELLA Z.

Röslerstammia vesperella Z. Stett. Ent. Ztg. XI. 156–7 no. 158 (1850)[1]. *Acrolepia vesperella* Hrtm. MT. Münch. Ent. Ver. IV. 4 no. 1529 (1880)[2]; Stgr-Rbl. Cat. Lp. Pal. II. 232 no. 4478 (1901)[3].

Hab. S. EUROPE[1-3]: ⊕ *Smilax aspera*, V, X, excl. IV, IX[2]—ITALY: Rome, 10–25. IV. 1893 (*Wlsm.*)—FRANCE: Monte Carlo, 19–22. VI. 1898 (*Wlsm.*). N. AFRICA[3]—MOROCCO: Tangier, 30–31. XII. 1901 (*Wlsm.*)—ALGERIA: El-Biar, 2. III – 7. IV.

1893 (*Eaton*); Ruisseau des Singes, Médéa, 26. VII. 1893 (*Eaton*). **Canaries**—TENERIFE: Las Mercedes, 30. III. 1904 (*Eaton*), 29. V - 7. VI. 1907 (*Wlsm.*); Cruz de Afur, 5. IV. 1904 (*Eaton*); Forest de la Mina, 9. IV. 1904 (*Eaton*); Guimar, 10. IV. 1907 (*Wlsm.*); La Laguna, 23–31. V. 1907 (*Wlsm.*); Tacaronte, 31. V. 1907 (*Wlsm.*).

Found commonly at various localities: not previously recorded from the Canaries.

106. (4489·1) ACROLEPIA PAPPELLA, sp. n.
(Plate LIII. fig. 15.)

Antennae fuscous, clearly spotted with white along their under sides. *Palpi* cinereous, shaded transversely with fuscous on each joint beneath. *Head* and *Thorax* cinereous, mixed with fuscous. *Forewings* pale cinereous, partially suffused with pale fawn, and speckled with fuscous; a series of black specks along the basal third of the costa, and some small, obscure, fuscous cloud-spots on the outer half of the costa; two rather larger cloud-spots on the dorsum, preceded and followed by white scaling, the white patch between them containing two short upright streaks of blackish speckling; a fuscous line along the termen, and a broader shade of the same on the outer half of the pale cinereous terminal cilia. *Exp. al.* 10–12 mm. *Hindwings* pale steely grey; cilia pale brownish cinereous. *Abdomen* and *Legs* greyish; the tarsi with pale spots at the joints.

Type ♀ (99151); ♂ (99152) Mus. Wlsm.

Hab. TENERIFE: Guimar, 28. II. 1907, ⊕ *Allagopappus dichotomus*, 28. II, excl. 30. III. 1907; Villa Orotava, ⊕, 19. II, excl. 19–30. III. 1907; Puerto Orotava, ⊕, 20. IV, excl. 27–30. IV. 1907. Twelve specimens.

Larva on *Allagopappus dichotomus*, mining the leading leaves, and pupating in a white open network cocoon among these, or on the stems. Two specimens taken on the wing at Guimar, where larvae were found the same day, and on different dates at Orotava.

52. (292) PLUTELLA Schrk.

107. (2447) PLUTELLA MACULIPENNIS Crt.

= *cruciferarum* Z.[6]

Cerostoma maculipennis Crt. Br. Ent. IX. Pl. **420**, expl. p. 2 (1832)[1]. *Plutella cruciferarum* Z. Stett. Ent. Ztg. IV. 281–3 (1843)[2]; Stn. Ann-Mag. NH. (3 s.). III. 212 (1859)[3]; Rbl. Ann. KK. Hofmus. VII. 272, 283 no. 53 (1892)[4]; Wlsm. Tr. Ent. Soc. Lond. **1894**, 537, 542 no. 26 (1894)[5]. *Plutella maculipennis* Wlsm. & Drnt. Ent. Mo. Mag. XXXIII. 173–5 (1897)[6]; Stgr-Rbl. Cat. Lp. Pal. II. 137 no. 2447 (1901)[7]; Dyar Bull. US. Nat. Mus. **52**. 492 no. 5503 (1902)[8]; Rbl. Ann. KK. Hofmus. XXI. 44 no. 207 (1906)[9]; Meyr. Pr. Lin. Soc. NSW. XXXII.

145–6 no. 284 (1907)[10]; Wlsm. Fn. Hawaii. I. 652–3, 751 no. 330 (1907)[11].

Hab. EUROPE[1-2, 7, 11]. ASIA[11]. AFRICA[11]. **Madeiras**[3-5, 9]—MADEIRA[3-5]: Funchal (*Wollaston*)[5]; San Antonio da Serra (*Wollaston*)[5]. **Canaries**[4-5, 9]—TENERIFE: La Laguna, 1. IV. 1904 (*Eaton*), 10. VI. 1907 (*Wlsm.*); Santa Cruz, 31. XII. 1906 (*Wlsm.*).—ALEGRANZA[4, 9]: 12. IX. 1890 (*Simony*)[4]. AMERICA[8]. HAWAIIA[11]. OCEANIA[11]. AUSTRALIA[10]. NEW ZEALAND[10].

Abundant everywhere.

53. (269) PORPE Hb.

=**CHOREUTIS* (Hb. p.) Stgr-Rbl.

Type *Tinea bjerkandrella* Thnb. (=*vibrana* Hb. 202) Hb. (1826).

PORPE Hb. Verz. Schm. 373 no. 3579 (1826). **CHOREUTIS* Stgr-Rbl. Cat. Lp. Pal. II. 129 no. 269 (1901); Dyar Bull. US. Nat Mus. **52**. 493–4 (1902).

Choreutis Hb. is a synonym of *Hemerophila* Hb., the type of both being *Phalaena* (*Tortrix*) *pariana* Cl.; Hübner's geneonym **Porpe** must therefore be used for *bjerkandrella* and its allies instead of *Choreutis*.

108. (2311) PORPE BJERKANDRELLA Thnbg.

Tinea bjerkandrella Thnbg. Diss. Ent. Ins. Suec. I. 24. Pl. [**1** 24–5] (1784)[1]: Diss. Ac. Upsal. III. 36. Pl. **4** · 24–5 (1801)[2] *Xylopoda pretiosana* Dp. HN. Lp. Fr. Sppl. IV. 182 no. 362. Pl. **65** · 9 (1842)[3]. *Choreutis bjerkandrella* E. Wlstn. Ann-Mag. NH. (5 s.). III. 342 (1879)[4]: Lp. St. Helena 29–30 (1879)[4]; Wlsm. Tr. Ent. Soc. Lond. **1894**. 537, 545 no. 36 (1894)[5]. *Choreutis pretiosana* Rbl. Ann. KK. Hofmus. VII. 266, 282 no. 43 (1892)[6]: XI. 122, 146 no. 173 (1896)[7]: XXI. 44 no. 202 (1906)[8]. *Choreutis bjerkandrella* Thnbg.+*pretiosana* Stgr-Rbl. Cat. Lp. Pal. II. 129 no. 2312[a] (1901)[9]. *Choreutis bjerkandrella* Meyr. Pr. Lin. Soc. NSW. XXXII. 109 no. 203 (1907)[10].

Hab. ASIA[9]. EUROPE[9]. **Madeiras**[5-6, 9]—MADEIRA[5]: Funchal (*Wollaston*)[5]. **Canaries**[5-9]—TENERIFE[5]: Santa Cruz, 10. I – 7. II. 1907, ⊕ *Inula viscosa*, 18. I, excl. 9–13. II. 1907 (*Wlsm.*), 3. V. 1895 (*Hedemann*)[7], 9. VIII. 1889 (*Simony*)[6]; La Laguna, 15–16. III. 1902, 6. IV. 1904 (*Eaton*); Guimar, ⊕ *Gnaphalium luteoalbum*, 25. II, excl. 11–23. III. 1907 (*Wlsm.*); IV. 1884 (*Leech*); Puerto Orotava, 1895 (*Hedemann*)[7], 3. V. 1907, ⊕ *Thistle*, 3. V, excl. 16. V. 1907 (*Wlsm.*). **St. Helena**[4]: Plantation; Cleugh's Plain; West Lodge (*E. Wollaston*)[4]. AUSTRALIA[10].

Taken and bred from *Gnaphalium* at Guimar, taken and bred from Thistles at Puerto Orotava, and bred from *Inula* at Santa Cruz: no difference can be found between the specimens.

54. (270) HEMEROPHILA Hb.

HEMEROPHILA Hb. (1806), Frnld., Dyar; =§*ANTHOPHILA* Hw. (1811); =SIMAETHIS Leach (1815), Stgr-Rbl.; [=*TEBENNA Blbg. (1820) LN.*]; =↓*XYLOPODE* Ltr. (1825); =*CHOREUTIS* Hb. (1826); =*EUTROMULA* Fröl. (1828); =*XYLOPODA* Ltr. (1829); =ENTOMOLOMA Rgt. (1875).

Type 1. *Phalaena Tortrix pariana* Cl. (Hb. 1806).

HEMEROPHILA Hb. Tent. p. [2] (1806). *CHOREUTIS* Hb. Verz. Schm. 373 (1826). *EUTROMULA* Fröl. Enum. Tort. Würt. 11 (1828).

Type 2. *Phalaena Tortrix fabriciana* L. (Leach 1815).

§ *ANTHOPHILA* Hw. Lp. Br. 471 (1811). SIMAETHIS Leach, Brewster's Edinb. Encycl. IX. 135 no. 466 (1815). [*TEBENNA Blbg. Enum. Ins. Mus. Blbg. 90 (1820) LN.*]. ↓*XYLOPODE* Ltr. Fam. Nat. Règne An. 476 (1825). *XYLOPODA* Ltr. Cuv. Règne An. (2 ed.). V. 412 (1829).

Type 3. *Tortrix nemorana* Hb.

XYLOPODA* (Ltr.) Dp. Ann. Soc. Ent. Fr. III. 448–9 no. 21 (1834): HN. Lp. Fr. IX. 24, 456 no. 21 (1834). ENTOMOLOMA Rgt. Bull. Soc. Ent. Fr. XLIV. (5 s. V: **1875). p. xliii (1875).

Choreutis Hb. must be sunk as a synonym of *Hemerophila* Hb., the type of both being *pariana* Cl.: *Simaethis* Leach (type *fabriciana* L.) and *Entomoloma* Rgt. (type *nemorana* Hb.) are potential geneonyms.

109. (2314) HEMEROPHILA NEMORANA Hb.

Tortrix nemorana Hb. Smlg. Schm. Eur. VII. Pl. **1** · 3 (1797)[1]. *Choreutis nemorana* Hb. Verz. Schm. 373 no. 3577 (1826)[2]. *Simaethis nemorana* Hrtm. MT. Münch. Ent. Ver. III. 194 no. 1305 (1879)[3]; Wlsm. Tr. Ent. Soc. Lond. **1894**. 537, 545 no. 37 (1894)[4]; Rbl. Ann. KK. Hofmus. VII. 266, 282 no. 44 (1892)[5]: XI. 122, 146 no. 173 (1896)[6]: XXI. 44 no. 203 (1906)[7]: Stgr-Rbl. Cat. Lp. Pal. II. 129 no. 2314 (1901)[8].

Hab. WC. ASIA[8]. S. EUROPE[8]: ⊕ *Ficus* VIII–IX, excl. IV–VI[3]—S. SPAIN: Granada, ⊕ *Ficus*, 4–11. VI, excl. 11. VI – 4. VII. 1901 (*Wlsm.*). N. AFRICA[8]—ALGERIA[5]: Constantine, 28. V. 1895 (*Eaton*); Médéa, 21. VII. 1893 (*Eaton*); Azazga, 2. IX. 1893 (*Eaton*). **Madeiras**[4, 6, 8]—MADEIRA[4]: The Mount (*Wollaston*)[4]. **Canaries**[5-8]—LA PALMA[5-7]: 20. VIII. 1889 (*Simony*)[5]—HIERRO[5-7]: 28. VIII. 1889 (*Simony*)[5]—TENERIFE[6-7]: Santa Cruz, 3. V. 1895 (*Hedemann*)[6]; Puerto Orotava, 4–14. V. 1907 (*Wlsm.*).

Taken and bred from Fig-trees: obviously an introduced species.

110. (2318) Hemerophila fabriciana L.

= *oxyacanthella* L.

Phalaena Tortrix fabriciana L. Syst. Nat. (ed. XII.). I. 880 no. 324 (1767)[1]. *Phalaena Tinea oxyacanthella* L. Syst. Nat. (ed. XII.). I. 886 no. 357 (1767)[2]. *Simaethis fabriciana* Stph. List Br. An. BM. V. Lp. 248 (1850)[3]; Stn. Ann-Mag. NH. (3 s.). III. 210 (1859)[4]. *Simaethis oxyacanthella* Hrtm. MT Münch. Ent. Ver. III. 194 no. 1309 (1879)[5]; Wlsm. Tr. Ent. Soc. Lond. **1894**. 537, 545 no. 38 (1894)[6]. *Simaethis fabriciana* Stgr-Rbl. Cat. Lp. Pal. II. 129 no. 2318 (1901)[7].

Hab. WC. ASIA[7]. EUROPE[1-7]: ⊕ *Urtica, Parietaria*[5]. **Madeiras**[4, 6-7]—Madeira[4]: (*Wollaston*)[4, 6]. **Canaries**—Tenerife: IV. 1884 (*Leech*).

I have a single specimen (61978), taken in Tenerife, in April 1884, by the late Mr. J. H. Leech, but did not myself meet with this species, which has not been recorded from the Canaries.

55. (272) GLYPHIPTERYX Hb.

111. (2333) Glyphipteryx pygmaeella Rbl.

Glyphipteryx pygmaeella Rbl. Ann. KK. Hofmus. XI. 132–3, 147 no. 247 (1896)[1]: XXI. 44 no. 204 (1906)[2]: Stgr-Rbl. Cat. Lp. Pal. II. 130 no. 2333 (1901)[3].

Hab. **Canaries**[1-3]—Tenerife[1-2]: Cruz de Afur, 5. IV. 1904 (*Eaton*); Puerto Orotava, 22. IV. 1895 (*Hedemann*)[1]; La Laguna, 7. VI. 1907 (*Wlsm.*)—Gran Canaria[1-2]: Las Palmas, 10. V. 1895 (*Hedemann*)[1].

One specimen only of this species was met with at La Laguna, on June 7th, I have also one from Mr. Eaton, taken near the Cruz de Afur, on April 5th.

112. (2336·1) Glyphipteryx fortunatella, sp. n.
(Plate LII. fig. 18.)

Antennae bronzy fuscous. *Palpi* white, spotted with fuscous along their outer sides. *Head* cupreous. *Thorax* bronzy fuscous. *Forewings* bronzy fuscous, blending to brownish cupreous beyond the middle; with five distinct white costal streaks, the first, about the middle of the costa, tending obliquely outward, longer than the second, which is a little beyond it, also oblique, but not parallel, tending rather to converge; after a space, at least equal to that which divides the first pair of streaks on the costa, there follows a series of three shorter streaks, their points slightly converging in the direction of a short, white, curved, terminal incision below the apex; beyond these the cilia form a sharply uncate apex, owing to the outer extremities of those below it being pure white, while their basal halves are bronzy grey surrounding a black apical spot; the whitened cilia, after contributing to the subapical incision, are continued along the termen to the tornus, with their basal halves bronzy cupreous; at the tornus is a short, silvery white, triangular spot, and from the middle of the dorsum arises a rather slender, slightly curved, outwardly oblique, white silvery streak, which nearly reaches to the apex of the first costal streak above it. *Exp. al.* 6–6·5 mm. *Hindwings* bronzy grey; cilia scarcely paler. *Abdomen* bronzy fuscous. *Legs* bronzy greyish, the spurs and joints white.

Type ♀ (99102); ♂ (99103) Mus. Wlsm.

Hab. TENERIFE: Guimar, 10–14. IV. 1907; Villa Orotava, 26. IV. 1907; Realejo, 7. V. 1907. Nineteen specimens.

Nearly allied to *fischeriella* Z., but differing in the middle white costal streak being always nearer to the following than to the preceding pair, whereas in *fischeriella* it is equidistant between them. It also differs in the more evenly slender, and more produced, oblique dorsal streak, which always reaches as far as, or a little beyond, the apex of the first costal. *G. fortunatella* is smaller than *pygmaeella*, and is common in the neighbourhood of Guimar, in the Barranco Badajos; it occurs also at Villa Orotava and Realejo.

V. PHALONIADAE.

56. (235) LOXOPERA Stph.

=†*LOZOPERA* Stph., Stgr-Rbl.

113. (1646) LOXOPERA FRANCILLONANA F.

=† *francillana* F., Stgr-Rbl.; =**flagellana* Rbl. (nec Dp.).

Pyralis francillana F. Ent. Syst. III. (2). 264–5 no. 94 (1794)[1]. *Lozopera francillonana* Wlsm. Ent. Mo. Mag. XXXIV. 71–2. Pl. **2**· 1a-d (1898)[2]. *Conchylis *flagellana* Rbl. Ann. KK. Hofmus. XI. 119, 146 no. 166 (1896)[3]. *Lozopera francillana* Stgr-Rbl. Cat. Lp. Pal. II. 94 no. 1646 (1901)[4]. *Conchylis francillana* Rbl. Ann. KK. Hofmus. XXI. 37, 43 no. 193 (1906)[5].

Hab. WC. ASIA[4]. EUROPE[1-2, 4]: ⊕ *Daucus carota*, *Ferula communis*[2]. **Canaries**[3-5]—TENERIFE[3-5]: Santa Cruz, ⊕ *Todaroa aurea*, 12. II, excl. 17. IV–29. V. 1907 (*Wlsm.*), 3. V. 1895 (*Hedemann*)[3].

Prof. Rebel (*l. c.* **5**) records *francillonana* from Tenerife, on the strength of a specimen in Mr. White's collection, remarking that it was almost certainly the same as the specimen collected by von Hedemann, at Santa Cruz, May 3rd, 1895, which (*l. c.* **3**) he had identified as **flagellana*. I met with *francillonana*, also at Santa Cruz, in February, feeding among the seeds of *Todaroa aurea*, an indigenous *Umbellifer*. The larvae soon left the seed-heads, and as I had taken no stems of the plant, when leaving Santa Cruz, they travelled restlessly round the bottles for many days after reaching Guimar: on being supplied with small pieces of *Bambusa*, and of the first *Umbellifer* I could find, they quickly gnawed their way into both of these and pupated, the moths emerging from April 17th to May 29th.

114. (1647) LOXOPERA BILBAËNSIS Rslr.

Conchylis francillana F. + *bilbaënsis* Rslr. Stett. Ent. Ztg. XXXVIII. 372 (1877)[1]. *Lozopera bilbaënsis* Wlsm. Ent. Mo. Mag. XXXIV. 72–3. Pl. 2· 2a-d (1898)[2]; Stgr-Rbl. Cat. Lp. Pal. II. 94 no. 1647 (1901)[3].

Hab. S. EUROPE[1-3]: ⊕ *Crithmum maritimum*[2]. **Canaries**—TENERIFE: La Laguna, 6. IV. 1904 (*Eaton*); Puerto Orotava, 4. V. 1907, ⊕ *Crithmum maritimum*, 29. IV, excl. 9. V – 17. VII. 1907, ⊕ *Ferula sp.*, 29. IV, excl. 29. VII. 1907 (*Wlsm.*); Bajomar, ⊕ *Astydamia canariensis*, 22. V, excl. 3. VI – 19. VIII. 1907 (*Wlsm.*).

Larvae found in stems of *Crithmum maritimum*, at Puerto Orotava, in May, produced paler and darker varieties from the beginning of May to the middle of July. I subsequently found it in great abundance in stems of *Astydamia canariensis*, at Bajomar, from which I reared a series of twenty specimens: a careful examination of the chitinous genital appendages shows them to be the same as in the *Crithmum*-feeder, and in a series of Spanish and Corsican specimens, also reared from *Crithmum*. A single specimen was also bred from the stems of a species of *Ferula*, found at Puerto Orotava. Were it not for the differences in the form of the uncus and claspers it would be exceedingly difficult to separate this species from *francillonana*, but the hind-wings are almost invariably paler. A somewhat worn specimen taken by Mr. Eaton, at La Laguna, in April 1904, is unfortunately a ♀, but I think it is certainly *bilbaënsis*.

57. (236) PHALONIA Hb.

= *CONCHYLIS* Tr., Stgr-Rbl.

115. (1666) PHALONIA CARPOPHILANA Stgr.

Cochylis carpophilana Stgr. Stett. Ent. Ztg. XX. 228–9 no. 45 (1859)[1]. *Conchylis carpophilana* Stgr-Rbl. Cat. Lp. Pal. II. 95 no. 1666 (1901)[2]. *Phalonia carpophilana* Wlsm. Ent. Mo. Mag. XXXVII. 235 (1901)[3].

Hab. S. EUROPE—S. SPAIN[1-3]: HUELVA: Coto, ⊕ *Asphodelus ramosus*, IVe, excl. 6–28. V. 1901 (*Wlsm.*)[1]. N. AFRICA—ALGERIA: Constantine, 16. VI. 1894 (*Eaton*). **Canaries**—TENERIFE: Santa Cruz, 22. I – 11. II. 1907; Guimar, 6–16. IV. 1907, ⊕ *Asphodelus ramosus*, 2–9. IV, excl. 13. IV. 1907 (*Wlsm.*).

Taken at Santa Cruz, in January, and at Guimar, in April—also bred from seeds of *Asphodelus ramosus* at the latter place, the bred specimen being much larger (*exp. al.* 17 mm.) than any individual of my Spanish bred series. The larvae were also observed at Puerto Orotava.

116. (1762·2) PHALONIA CONVERSANA, sp. n.
(Plate LIII. fig. 6.)

Antennae pale greyish. *Palpi* white, brownish fuscous on the outer side of the median joint. *Head* and *Thorax* white. *Forewings* white, with a faint subochreous suffusion, and a few sparsely sprinkled black scales, between, but not contiguous to, the dark markings, which consist of more or less thickly sprinkled black scales on a browner, or greyish brown, ground; the dark markings are as follows: an elongate streak from the base of the costa, a narrow medio-costal spot, a larger costal spot between this and the apex, with a small one beyond it before the apex; an oblique, straight, dorsal streak, of even width, terminated on the cell, and a faint shade above, forming a subcontinuous fascia with the medio-costal spot; a rather triangular dorsal spot, beyond the middle, half-way between the oblique streak and the tornus, with some dark sprinkling above it, running obliquely in the direction of the larger costal spot, and a narrow shade along the termen, followed by parallel dark lines running through the cilia. *Exp. al.* 9–14·5 mm. *Hindwings* slightly sinuate; pale brownish grey; cilia shining, silvery grey, becoming shining white on their outer halves. *Abdomen* pale brownish grey. *Legs* almost white, unspotted.

Type ♂ (99104); ♀ (99105) Mus. Wlsm.

Hab. TENERIFE: Guimar, 25. III – 9. IV. 1907 (*Wlsm.*); La Laguna, 6. IV. 1904 (*Eaton*); Puerto Orotava, 26. IV. 1907 (*Wlsm.*). Thirty-two specimens.

Taken among *Artemisia canariensis*, from which, but from no other plant, they were easily dislodged by beating: I was unable to discover the larva. Differing from *versana* Wlsm. in its more distinct and darker markings, and especially in the form of the oblique dorsal streak, which is rather more oblique, and of even width throughout.

58. (237) PHARMACIS Hb.

=*EUXANTHIS* Hb., Stgr-Rbl.

117. (1723) PHARMACIS CHAMOMILLANA HS.

Cochylis chamomillana HS. SB. Schm. Eur. IV. 183 no. 128, *chamomilana* Pl. **53**·377 (1851)[1]. *Conchylis chamomillanà* Stgr-Rbl. Cat. Lp. Pal. II. 97 no. 1723 (1901)[2]. *Pharmacis chamomillana* Wlsm. Ent. Mo. Mag. XXXIX. 181 (1903)[3].

Hab. WC. ASIA[2]. S. EUROPE[1-2]. N. AFRICA[2-3]—TUNIS[2]

—MOROCCO: Tangier, III. 1885 (*Leech*), 21. IV. 1902 (*Wlsm.*)[3]. **Canaries**—TENERIFE: Miramar, Santa Cruz, 1. I. 1907.

A single specimen of this rare species occurred near Miramar, two miles from Santa Cruz, on January 1st.

This species, as also *elongana* FR. (1724), and *impurana* Mn. (1725), must be removed from *Phalonia* to *Pharmacis.*

VI. TORTRICIDAE.

TORTRICINAE.

59. (221) EPAGOGE Hb.

=*DICHELIA* Gn., Stgr-Rbl.

118. (1490) EPAGOGE CONSTANTI Rbl.

Dichelia constanti Rbl. Ann. KK. Hofmus. IX. 17, 85–6 no. 149 (1894)[1]: XXI. 43 no. 184 (1906)[2]: Stgr-Rbl. Cat. Lp. Pal. II. 84 no. 1490 (1901)[3].

Hab. TENERIFE[1-3]: La Laguna, ⊕ *Datura stramonium*, excl. V–VI (*Cabrera*)[1].

This is one of the very few species, recorded from Tenerife, which I was unable to find, although I searched on *Datura stramonium*, at La Laguna, in May and June—the time and place of its recorded occurrence.

60. (227) TORTRIX L.

I fear I may be in part responsible for the too-extended use of the geneonym *Pandemis* Hb., having placed in that genus certain South African species possessing a very faint indication of a notch at the base of the antennae: neither in these, nor in any of the Tenerife species with which I am acquainted, is there any sufficient indication of this character to justify their separation from *Tortrix* L. I might have been disposed to place them in *Dipterina* Meyr., separated from *Tortrix* L. by Meyrick on account of the presence of a distinct secondary cell in the forewings, by the stalking of veins 6 and 7 in the hindwings, and by the long ciliation of the ♂ antennae; but an examination of *Dipterina tasmaniana* Wkr. shows that veins 6 and 7 of the hindwings are not truly stalked, although tending to coincidence towards the base, the secondary cell is less strongly indicated than in *Clepsis* Gn. (*rusticana* Tr.), with which it agrees in the long ciliation of the antennae. Meyrick has himself placed *rusticana* in the genus *Tortrix*, evidently regarding the ciliation of the antennæ as merely a question of degree; our Tenerife species, possessing no well-indicated secondary cell, must therefore be included in the older and more generally recognised genus *Tortrix* L.

119. (1542) Tortrix simonyi Rbl.

=† *symonyi* Rbl.

Pandemis simonyi Rbl. Ann. KK. Hofmus. VII. 263–5, 282 no. 40. Pl. **17** · 8 ♂–9 ♀ (1892)[1]. *Pandemis symonyi* Rbl. Ann. KK. Hofmus. IX. 17, 82 no. 145 (1894)[2]: XXI. 43 no. 186 (1906)[3]. *Pandemis simonyi* Stgr-Rbl. Cat. Lp. Pal. II. 87 no. 1542 (1901)[4].

Hab. **Canaries**[1–4]—La Palma[1–3]: Barranco de las Angustias, 900 m., 16–18. VIII. 1889 (*Simony*)[1]—Tenerife[2–3]: Montaña de Guerra, VI. (*Cabrera*)[2]—Gran Canaria[1–3]: (*Richter*)[1].

My series of *persimilana* seems to contain forms agreeing with *simonyi*, but having no specimens from La Palma, I hesitate to unite the two species, as Rebel had both before him when describing *persimilana*.

120. (1543) Tortrix persimilana Rbl.

n. syn.=*mactana* Rbl.

Pandemis persimilana Rbl. Ann. KK. Hofmus. IX. 17, 82 no. 144 (1894)[1]: XI. 117–8, 146 no. 160 (1896)[2]. *Pandemis mactana* Rbl. Ann. KK. Hofmus. XI. 116–7, 146 no. 158. Pl. **3** · 4 ♂ (1896)[3]: XIII. 376, 380 no. 172 (1899)[4]: Stgr-Rbl. Cat. Lp. Pal. II. 87 no. 1544 (1901)[5]. *Pandemis persimilana* Stgr-Rbl. Cat. Lp. Pal. II. 87 no. 1543 (1901)[6]: Ann. KK. Hofmus. XXI. 43 no. 187 (1906)[7]. *Pandemis mactana* Rbl. Ann. KK. Hofmus. XXI. 43 no. 188 (1906)[8].

Hab. **Canaries**[1–8]—Tenerife[1–7]: "? Cafira," 14. II. (*Alluaud*)[3]; Los Silos, 25. II. 1898 (*Hintz*)[4]; Guimar, 2. III–12. IV. 1907, ⊕ *Rosa banksiae*, 27. II, excl. 23. III. 1907, ⊕ *Rubus fruticosus*, 25. II, excl. 24. III. 1907, ⊕ *Globularia salicina*, 27. III, excl. 12–26. IV. 1907, ⊕ *Pelargonium*, 27. III, excl. 22. IV. 1907, ⊕ *Jasminum odoratissimum*, 27. III, excl. 27. IV. 1907 (*Wlsm.*); Santa Cruz, ⊕ *Coffea arabica*, 1. I, excl. 23. III. 1907 (*Wlsm.*); Toso, 25. III. 1898 (*Hintz*)[4]; IV. 1884 (*Leech*)[1]; Cruz de Afur, 5. IV. 1904 (*Eaton*); Forest de la Mina, 9. IV. 1904 (*Eaton*); Arafo, 13. IV. 1907 (*Wlsm.*); Pedro Gil, ⊕ *Cytisus proliferus*, 19. IV, excl. 8. V. 1907 (*Wlsm.*); Las Mercedes, 29. V. 1907 (*Wlsm.*); Puerto Orotava, 1896 (*Crompton*), ⊕ *Globularia salicina*, 7. V, excl. 29. V. 1907 (*Wlsm.*); La Laguna, 30. V. 1907, ⊕ *Adenocarpus foliolosus*, 18. V, excl. 7–14. VI. 1907, ⊕ *Erica arborea*, 23. V, excl. 13. VI. 1907 (*Wlsm.*)—Gran Canaria[2–4, 7–8]: Las Palmas, 8–11. V. 1895 (*Hedemann*)[2–3].

Comparing the types of *persimilana* Rbl. (60994 ♀, 61000 ♀: Mus. Wlsm.) with a considerable series of bred and captured specimens, and bearing in mind the examples of *Pandemis mactana* Rbl. in Mr. White's collection, at Guimar, I am forced to the conclusion that these names are applied to different varieties of the same species. Many of the ♂ ♂ agree perfectly with

Rebel's description of *mactana*, although paler forms, less reticulated on the under side of the forewing, also occur: there is however no possible line of demarcation between them. Some very fine fasciated ♀♀, with typical *persimilana* ♀♀, and typical *mactana* ♂♂, were bred from larvae on *Globularia salicina*, at Guimar, in April and May, 12 specimens in all, including a single ♂ bred from the same plant at Puerto Orotava. I have also bred six similar forms from *Adenocarpus foliolosus*, at La Laguna, in June; 1 ♂, in March, on Banksia rose, Guimar; 1 ♂, March, on *Rubus fruticosus*, Guimar; 1 ♀, April, on Geranium, Guimar; 1 ♀, May, on *Cytisus proliferus*, Pedro Gil; 1 ♂, March, on *Schinus molle*, Santa Cruz; 1 ♂, March, from Coffee-plant, in a garden at Miramar, near Santa Cruz; 1 ♀, June, on *Erica arborea*, La Laguna; 1 ♀, April, from *Jasminum odoratissimum*, Guimar; 16 caught specimens make up the series of 42, to which I can add, 2 received from Mr. White, and 6 previously in my cabinet from the late Mr. J. H. Leech, and from Mr. Eaton: 50 in all.

121. (1545) Tortrix bracatana Rbl.

Pandemis bracatana Rbl. Ann. KK. Hofmus. IX. 17, 82–4 no. 146 (1894)[1]: XXI. 43 no. 189 (1906)[2]: Stgr-Rbl. Cat. Lp. Pal. II. 87 no. 1545 (1901)[3].

Hab. Tenerife[1-3]: Agua Garcia, VI. 1892 (*Cabrera*)[1], ⊕ *Viburnum rugosum*, 31. V, excl. 17. VI. 1907 (*Wlsm.*).

A fine and distinct species, of which I have only a single specimen, bred from a larva found rolling the leaves of *Viburnum rugosum* at Agua Garcia; the type was taken in the same locality by Cabrera in 1892.

122. (1594·1) Tortrix canariensis Rbl.

=**subcostana* Rbl. (nec Stn.).

*Cacoecia *subcostana* Rbl. Ann. KK. Hofmus. IX. 16, 81–2 no. 143 (1894)[1]. *Tortrix* (**subcostana* Rbl.) Wlsm. Tr. Ent. Soc. Lond. **1894**. 539 (1894)[2]. *Tortrix subcostana* Stn. + *canariensis* Rbl. Ann. KK. Hofmus. XI. 116, 146 no. 157 (1896)[3]: Stgr-Rbl. Cat. Lp. Pal. II. 90 no. 1594[a] (1901)[4].

Hab. **Canaries**[1-4]—Tenerife[1-3]: Guimar, 9. III – 16. IV. 1907 (*Wlsm.*); Las Mercedes, 17. III. 1902, 29. III. 1904 (*Eaton*), 19. V – 7. VI. 1907 (*Wlsm.*); IV. 1885 (*Leech*)[1-2]; Tejina, 7. IV. 1904 (*Eaton*); Arafa, 13. IV. 1907 (*Wlsm.*); Realejo, 7. V. 1907 (*Wlsm.*); Villa Orotava, 14. V. 1907 (*Wlsm.*); La Laguna, 21. V. 1889 (*Krauss*)[1], 23. V – 9. VI. 1907 (*Wlsm.*); Santa Cruz, 25. V. 1889 (*Krauss*)[1]; Tacaronte, 31. V. 1907 (*Wlsm.*).

This is an exceedingly variable species, and at first sight seems very distinct from the larger and more distinct form which I have received from Madeira. A series of 74 specimens, taken in various localities, enables me to separate them satisfactorily: in *subcostana* Stn. the dark fascia is always more oblique, and its inner margin always less irregular than in *canariensis.* It occurs on high ground among *Hypericum*, at a lower elevation among *Erica arborea*, and lower yet, at La Laguna and elsewhere, among *Rubus*. I was at first disposed to regard the larger specimens, beaten from *Hypericum*, as distinct from those among *Rubus*, but this cannot be maintained.

123. (1596) TORTRIX CORIACANA Rbl.

=**longana* Rbl. (+3 **stratana* Rbl.) nec Hw., nec Z.

Sciaphila **longana* (+3 **stratana*) Rbl. Ann. KK. Hofmus. VII. 265–6, 282 no. 41[3] (1892)[1]. *Heterognomon coriacanus* Rbl. Ann. KK. Hofmus. IX. 17, 84 no. 148 (1894)[2]: XI. 118, 146 no. 163 (1896)[3]: XIII. 376–7, 380 no. 177 (1899)[4]: XXI. 43 no. 191 (1906)[5]: Stgr-Rbl. Cat. Lp. Pal. II. 90 no. 1596 (1901)[6].

Hab. **Canaries** [1–6]—TENERIFE [1–5]: Santa Cruz, 21. XII – 16. II. 1907, ⊕ *Psoralea bituminosa*, 5. I, excl. 30. I. 1907, ⊕ *Rhamnus crenulata*, 16. I, excl. 10. II. 1907, ⊕ *Periploca laevigata*, 27. I, excl. 4. III. 1907, ⊕ *Artemisia argentea*, 11. II, excl. 7. III. 1907, ⊕ *Fagonia cretica*, 26. I, excl. 21. II – 10. III. 1907 (*Wlsm.*), 12. V. 1889 (*Krauss*)[2], 1895 (*Hedemann*)[3]; La Laguna, 13. I. 1907 (*Wlsm.*), 23. II – 8. IV. 1904, 17. III. 1902 (*Eaton*), 21. V. 1889 (*Krauss*)[2], 23. V. 1907 (*Wlsm.*); Cafira, 14. II. (*Alluaud*)[3]; Villa Orotava, 19. II. 1907, ⊕ *Rhus coriaria*, 28. IV, excl. 2. V. 1907 (*Wlsm.*); Los Silos, 22. II. 1898 (*Hintz*)[4]; Guimar, 28. II – 14. IV. 1907 (*Wlsm.*), 21. III. 1904 (*Eaton*), ⊕ *Poterium sp.*, 26. II, excl. 18. III. 1907, ⊕ *Rubus fruticosus*, 25. II, excl. 21. III – 4. IV. 1907, ⊕ *Rumex lunatus*, 19. III, excl. 26. IV. 1907, ⊕ *Notochlaena marantae*, 27. II, excl. 31. III. 1907, ⊕ small *Crucifer*, 3. III, excl. 31. III. 1907, ⊕ *Artemisia canariensis*, 19. III, excl. 5–20. IV. 1907, ⊕ *Pyrus malus*, 3. IV, excl. 14. IV, 1907, ⊕ *Psoralea bituminosa*, 1. III, excl. 27. IV. 1907, ⊕ *Cistus monspeliensis*, 8. IV, excl. 6. V. 1907, ⊕ *Phelipaea sp.*, 15. IV, excl. 8. V. 1907 (*Wlsm.*); Puerto Orotava, 13. III. 1904 (*Eaton*), 10–28. IV. 1895 (*Hedemann*)[3], 23. IV – 10. V. 1907, ⊕ *Senecio kleinia*, 26. IV, excl. 21. V. 1907, ⊕ *Ononis sp.*, 27. IV, excl. 8. VI. 1907, ⊕ *Tamarix gallica*, 5. V, excl. 12. VI. 1907 (*Wlsm.*); Tejina, 18. III. 1902 (*Eaton*); IV. 1885 (*Leech*)[2]; Forest de la Mina, 7. IV. 1904 (*Eaton*); Bajomar, ⊕ *Astydamus canariensis*, 22. V, excl. 29. V – 15. VI. 1907, ⊕ *Lotus sp.*, 25. V, excl. 1–17. VI. 1907 (*Wlsm.*); Loma de la Vega, Icod de los Vinos, 3. VIII. 1889 (*Simony*)[1] — GRAN CANARIA [3–5]: 1895 (*Hedemann*)[3]; Las Palmas, ⊕ *Plocama pendula*, 15. VI, excl. 28. VI. 1907 (*Wlsm.*)—LANZAROTE [1, 4–5]: Yaiza, 4. X. 1890 (*Simony*)[1].

Here again we have a species which varies greatly within certain limits, but is easy to recognise. It reminds one at first sight of *canariensis* Rbl., but the wings are more pointed, the costa being somewhat less arched, and the termen more oblique. I have bred it from *Psoralea*, *Artemisia*, *Rubus*, *Fagonia*, *Rhus*, *Rhamnus*, *Notochlaena*, *Astydamia*, *Cistus*, *Tamarix*, *Ononis*, *Lotus*, *Senecio*, *Poterium*, *Rumex*, *Periploca*, dry aborted apples, small *Cruciferae*, and even from *Phelipaea*.

Heterognomon hyeranus Rbl. Ann. KK. Hofmus. IX. 17, 84 no. 147 (1894)[1]. *Dichelia hyerana* Rbl. Ann. KK. Hofmus. XXI. 43 no. 185 (1906)[2].

Hab. TENERIFE[1-2]: La Laguna, V (*Cabrera*)[1].

I have many ♀♀ of *Tortrix coriacana* Rbl. which greatly resemble Millière's species in appearance, and am strongly convinced that the condition of the specimen examined and recorded by Rebel must have misled him. The reference to *Dichelia* (when the specimen was not available for study of neuration) can hardly be held to confirm the original determination, in the absence of information as to whether veins 7 and 8 were separate or stalked in the specimen recorded. It will probably be found that *hyerana* does not occur in Tenerife.

[228. CNEPHASIA Crt.]

124. (1608) TORTRIX LONGANA Hw.

=**segetana* Rbl. (nec Z.); =**fragosana* Rbl. (nec Z.)[5].

Tortrix longana Hw. Lp. Br. 463–4 no. 221 (1811)[1]. *Sciaphila longana* (+*ictericana* Rbl., +**stratana* Rbl.) Rbl. Ann. KK. Hofmus. VII. 265–6, 282 no. 41[1-2] (1892)[2]: IX. 17, 86 no. 150 (1894)[3]. *Sciaphila* **fragosana* Rbl. Ann. KK. Hofmus. IX. 17, 86 no. 151 (1894)[4]. *Sciaphila longana* Rbl. Ann. KK. Hofmus. XI. 119, 146 no. 165 (1896)[5]. *Cnephasia longana* Stgr-Rbl. Cat. Lp. Pal. II. 91 no. 1608 (1901)[6]: Rbl. Ann. KK. Hofmus. XXI. 37, 43 no. 192 (1906)[7].

Hab. WC. ASIA[6]. EUROPE[1-7]—CORSICA: Ile Rousse, 5. VI. 1898 (*Wlsm.*).—S. SPAIN: MALAGA: Cala Moral, 4. V. 1901 (*Wlsm.*): CADIZ: Cadiz, 14–15. V. 1902 (*Wlsm.*)—GIBRALTAR: ⊕ *Stachys circinata*, 2. III, excl. 9. V. 1901 (*Wlsm.*). N. AFRICA—ALGERIA: Constantine, 10. V. 1895, 14–15. VI. 1894 (*Eaton*). **Canaries**[2-7]—TENERIFE[3-5, 7]: Santa Cruz, 26. I – 11. II. 1907, ⊕ *Fagonia cretica*, 26. I, excl. 28. II. 1907, ⊕ *Stachys sp.*, 31. I, excl. 5. III. 1907, ⊕ *Argyranthemum pinnatifidum*, 10. II, excl. 2. IV. 1907 (*Wlsm.*), 3. IV. 1904 (*Eaton*), 10. IV – 4. V. 1895 (*Hedemann*)[5], 3. V – 1. VI. 1889 (*Krauss*)[3]; Guimar, 1906 (*White*)[7], 4. III – 16. IV. 1907, ⊕ *Psoralea bituminosa*, 1. III, excl. 10. IV. 1907 (*Wlsm.*); IV. 1885 (*Leech*)[4]; Puerto Orotava, 12–24. IV. 1895 (*Hedemann*)[5], 10. V. 1907 (*Wlsm.*); La Laguna, 16. III. 1902, 26. III – 6. IV. 1904 (*Eaton*), 2. V. 1907 (*Wlsm.*)—GRAN CANARIA[2-3, 5, 7]: (*Richter*)[2].

Very common everywhere, and exceedingly variable, ranging from unicolorous chalk-white, through various gradations of greyish ochreous and brownish grey, to slightly, and conspicuously fasciated forms, more or less speckled between the fasciae. I bred it from *Argyranthemum pinnatifidum*, from *Fagonia cretica*, from *Psoralea bituminosa*, and from *Stachys sp.*: a series of thirty-two selected specimens was preserved, in addition to several specimens received from the late Mr. J. H. Leech, and from Mr. Eaton.

OLETHREUTINAE.

61. (247) ACROCLITA Ldr.

125. (1966·01) Acroclita guanchana, sp. n. (Plate LIII. fig. 5.)

Antennae hoary greyish. *Palpi* porrect, slightly dependent, stretching the length of the head beyond it, densely clothed, especially above, terminal joint short, smooth; hoary grey, fuscous on the outer sides. *Head* hoary greyish, with some mixture of reddish brown scales. *Thorax* reddish brown. *Forewings* elongate, narrow, costa moderately arched, termen oblique, sinuate, tornus evenly rounded; tawny reddish brown, with some black scaling which is sometimes reduced to a few marginal specks, but in some varieties forms an elongate series of streaks or spots, more or less connected, or detached, commencing at the middle of the base, exhibited again along the cell beyond it to the apex; in one dark variety (99115) these streaks form an almost continuous line, with a diverging point along the fold; in another, paler, and faintly mottled form (99116) they are broken into three separate streaks, one from the base along the first half of the fold, a shorter one toward the end of the cell, and an outer one beyond the cell to the apex, with two minute spots below the intermediate spaces and one near the base of the dorsum; in the paler varieties there is also some indication of lighter geminated costal streaks, with alternating faint shade-spots; cilia slightly paler than the wing, with a distinctly paler line along their base, followed by parallel shade-lines running through them. *Exp. al.* 12–15 mm. *Hindwings* broader than the forewings, with oblique, sinuate, termen; grey with a slight rosy tinge; cilia paler, with a faint shade-line a little beyond their paler base. *Abdomen* and *Legs* griseous, varying to subochraceous; hind tarsi faintly shaded, except at the joints.

Type ♂ (99115); ♀ (99118); var. ♂ *PT.* (99116–7) Mus. Wlsm.

Hab. Tenerife: Santa Cruz, 3000 ft., 3. I. 1907, ⊕ *Hypericum grandifolium*, 3. I, excl. 29–31. I. 1907 (*Wlsm.*); Villa Orotava, 19. II. 1907 (*Wlsm.*); Forest de la Mina, 7. IV. 1904 (*Eaton*); Guimar, 10. IV. 1907, ⊕ *Hypericum grandifolium*, 25. II, excl. 7. IV – 4. V. 1907 (*Wlsm.*); Las Mercedes, 14. V. 1907 (*Wlsm.*); Tacaronte, 31. V. 1907 (*Wlsm.*). Fifteen specimens.

The larva contorts the leading leaves of *Hypericum grandifolium*: I met with it first at the Barranco del Bufadero, near Santa Cruz, the beginning of January, and bred specimens from the end of that month till the beginning of May.

126. (1966) ACROCLITA SUBSEQUANA HS.

126+a. (1966+a) SUBSEQUANA HS.+SUBSEQUANA HS.

=*consequana* HS.[1]; =*littorana* Cnst.

Semasia subsequana HS. SB. Schm. Eur. IV. 247 no. 337 (1851)[1].
Tortrix consequana HS. SB. Schm. Eur. IV. Pl. **59** · 423 (1854)[2].
Acroclita consequana Stgr-Rbl. Cat. Lp. Pal. II. 110 no. 1966 (1901)[3].

Hab. EUROPE[1-3]: ⊕ *Euphorbia spp.*

126+b. (1966+b) SUBSEQUANA HS.+CONVALLENSIS, var. n. (an sp. n. ?).

=**littorana* Rbl. (nec Cnst.).

Acroclita consequana HS.+*littorana* Rbl. Ann. KK. Hofmus. VII. 266, 282 no. 42 (1892)[1]: XI. 121, 146 no. 169 (1896)[2]: XXI. 43 no. 196 (1906)[3].

Hab. **Canaries**[1-3]—TENERIFE[2-3]: Santa Cruz, 25. I. 1907, ⊕ *Euphorbia regis-jubae*, 27. XII, excl. 28–31. I. 1907 (*Wlsm.*); Guimar, 6. III – 10. IV. 1907 (*Wlsm.*); IV. 1884 (*Leech*); Puerto Orotava, 18. IV. 1895, ⊕ *Euphorbia arborescens*, excl. 10–13. V. 1895 (*Hedemann*)[2] — GRAN CANARIA[1]: (*Richter*)[1] — MONTAÑA CLARA[1-3]: 238 m., 8. IX. 1890 (*Simony*)[1].

I did not meet with any form of *Acroclita* that can well be compared with *littorana* Cnst., which is merely a small pale variety of the ordinary South European *subsequana* HS. There is however one point of difference by which my Tenerife series of twenty-three specimens might be separated from European specimens: the basal patch always tends to throw out a pointed projection along the dorsum, they also range to a much larger average size (*exp. al.* 13–22 mm.), and I propose the neonym **convallensis** (var., an sp. ?), to distinguish them.

Type ♂ (99171); ♀ (99172) Mus. Wlsm.

127. (1966·1) ACROCLITA SONCHANA, sp. n. (Plate LIII. fig. 3.)

Antennae hoary, with blackish annulations, sometimes entirely suffused with black. *Palpi* whitish, thickly sprinkled with dark fuscous externally; sometimes fuscous throughout. *Head* dirty white, varying to dark fuscous. *Thorax* whitish, or dark fuscous; sometimes with chestnut-brown tegulae. *Forewings* dark fuscous, sprinkled and mottled with shades of chestnut-brown, with some paler spaces; a dark basal patch, extending to one-third, projects outwardly above the fold receding to the costa and nearly to the dorsum; this is followed by an irregular fascia, running from the middle of the costa to the dorsum before the tornus, throwing a projection inward from its middle and slightly bulging outward above its lower extremity; beyond it is a triangular shade-patch, more or less furcate to the costa, the apex and termen being also narrowly shaded; in some specimens (99110) the intermediate spaces between these markings, as well as the dorsal portion of the basal patch are white, sparsely sprinkled with brownish scales; in other specimens (99109) they are entirely suffused with dark steely greyish fuscous, paler only at the edges of the dark markings; about four pairs of geminate costal streaks are visible on the outer half of the wing; cilia fuscous, with a more or less defined shade-line along their base. *Exp. al.* 14–17 mm. *Hindwings* brownish cinereous, with a slender pale line along the base of the rather more smoky cinereous cilia; in the paler specimens the hindwings are also of a lighter shade. *Abdomen* and *Legs* corresponding to the hindwings in colour; tarsi darkly shaded between the pale joints.

Type ♀ (99108); ♂ (99109); ⊕ (99111); var. ♀ *PT.* (99110) Mus. Wlsm.

Hab. TENERIFE: Guimar, 7. IV. 1907, ⊕ *Sonchus gummifer*, 9–27. III, excl. 4. V – 12. VI. 1907; Puerto Orotava, ⊕ *Sonchus gummifer*, 23. IV, excl. 13. V – 19. VI. 1907, ⊕ *Sonchus leptocephalus*, 22. IV – 11. V, excl. 5. VI – 2. VIII. 1907. Fifteen specimens.

The larva, which is dull greyish, turning to bright red before pupation, feeds on the leaves outside the stems of *Sonchus gummifer* and *leptocephalus*. The moth is extremely variable, some specimens being almost black, on which the pattern, although easily traceable and very consistent, is much obscured, while in others all the intermediate spaces being white, the darker markings stand out very conspicuously. As compared with *consequana* HS., it is somewhat similar in general design, but the outer fascia is less oblique and less prominently angulated outward below the middle, while the space between this and the apex is more occupied by darker patches and the costal streaks are less confluent and less oblique.

62. (243) POLYCHROSIS Rgt.

128. (1954·1) POLYCHROSIS NEPTUNIA, sp. n. (Plate LIII. fig. 1.)

Antennae ochreous, varied with black above. *Palpi* ochreous. *Head* and *Thorax* ochreous, varying to reddish fuscous in some specimens. *Forewings* ochreous, varying to brownish ochreous, and even to reddish fuscous, the darker shades prevailing especially towards the dorsum; the costa is delicately speckled with fuscous throughout; before the middle is an outwardly oblique, greyish white fascia, somewhat contracted on the fold, terminating on the middle of the dorsum, its upper half slightly reticulated, or speckled, with the ochreous ground-colour; beyond it a narrow dark space separates it from a broad, irregular, second fascia of the same colour, tending to become widely furcate toward the costa, and narrowly furcate where it is inverted to the dorsum before the tornus; the outer portion of this fascia is usually joined to a sinuate streak, which, cutting off the dark apex of the wing, descends to the middle of the termen; these markings all contain more or less, short, parallel, wavy streaks of the darker ground-colour; cilia varying from ochreous to greyish, sometimes slightly mottled. *Exp. al.* 9–12 mm. *Hindwings* pale brownish grey; cilia pale cinereous with a slender shade-line running through them near their base. *Abdomen* greyish fuscous. *Legs* pale brownish cinereous, the tarsi very faintly spotted.

Type ♀ (99106); ♂ (99107) ex ⊕ *Statice*, Mus. Wlsm.

Hab. Tenerife: Guimar, 17. III. 1907, ⊕ *Frankenia ericifolia*, 6. III, excl. 9. III – 22. IV. 1907, ⊕ *Statice pectinata*, 6. III, excl. 20. III – 18. IV. 1907 (*Wlsm.*); Tejina, 18. III. 1902 (*Eaton*); Puerto Orotava, 21. IV – 14. V. 1907, ⊕ *Frankenia ericifolia*, 21. IV, excl. 3–4. V. 1907, ⊕ *Statice pectinata*, 21. IV, excl. 26. V – 7. VI. 1907 (*Wlsm.*). Thirty-two specimens (13 ex *Statice*, 10 ex *Frankenia*, 9 captured).

The larva feeds on *Statice pectinata* and *Frankenia ericifolia*, at Guimar and Puerto Orotava, from both of which plants I have bred it.

Most nearly allied, perhaps, to *limoniana* Mill., but differing in the markings being intermediate between those of that species and *botrana* S-D.

63. (255) BACTRA Stph.

129. (2017) Bactra lanceolana Hb.

Tortrix lancealana Hb. Smlg. Eur. Schm. VII. Pl. **13** · 80 (1797) [1]. *Ancylis lanceolana* Hb. Verz. Schm. 376 no. 3614 (1826) [2]. *Aphelia lanceolana* Wlsm. Tr. Ent. Soc. Lond. **1881**. 231–2 (1881) [3]; Meyr. Pr. Lin. Soc. NSW. VI. 651–2 (1881) [4]. *Bactra lanceolana* Wlsm. Tr. Ent. Soc. Lond. **1894**. 537, 540 no. 9 (1894) [5]; Rbl. Ann. KK. Hofmus. IX. 17, 86–7 no. 152 (1894) [6]: XI. 120–1, 146 no. 168 (1896) [7]: XXI. 43 no. 197 (1906) [8]; Wlsm. Pr. Z. Soc. Lond. **1897**. 121–2 no. 162 (1897) [9]: Ann-Mag. NH. (7 s.). VI. 333–4 no. 1006 (1900) [10]; Stgr-Rbl. Cat. Lp. Pal. II. 113 no. 2017 (1901) [11]; Frnld. Bull. US. Nat. Mus. **52**. 449 no. 5006 (1902) [12].

Hab. EUROPE [1–2, 11]: ⊕*Juncus*, *Cyperus* [6]. AFRICA [3]. ASIA [10]. MALAYSIA [10]. AUSTRALIA [4]. NEW ZEALAND [4]. S. AMERICA [9]. N. AMERICA [12]. W. INDIES [9]. **Madeiras** [5]—Madeira [5]: San Antonio da Serra (*Wollaston*) [5]; Machico, 23. IV. 1904 (*Eaton*). **Canaries** [6–8]—Tenerife [6–8]: Guimar, 4. III – 7. IV. 1907 (*Wlsm.*); IV. 1884 (*Leech*); Puerto Orotava, 14. V. 1907 (*Wlsm.*); 1895 (*Hedemann*) [7]; Santa Cruz, 26. V. 1889 (*Krauss*) [6] —Gran Canaria [7]: Las Palmas, 7. V. 1895 (*Hedemann*) [7].

The examples of this species which I met with in Tenerife could by no possibility have fed upon rushes; they were taken on an absolutely dry spot, in a barranco near Orotava, where no rushes could be found. I also took three specimens at Guimar. Mr. Eaton notes it as taken amongst *Carex*, in a wet place, near Machico (Madeira).

64. (241) RHYACIONIA Hb.

Rhyacionia Hb. Verz. Schm. 379 (1826); Wlsm. Ann-Mag. NH. (7 s.). VII. 124 (1900); =**Evetria* (Hb.) Stgr-Rbl. Cat. Lp. Pal. II. 102 no. 241 (1901).

130. (1845) Rhyacionia walsinghami Rbl.

Retinia walsinghami Rbl. Ann. KK. Hofmus. XI. 119–20, 146 no. 167, Pl. **3**·6 ♀ (1896)[1]. *Evetria walsinghami* Stgr-Rbl. Cat. Lp. Pal. 102 no. 1845 (1901)[2]: Ann. KK. Hofmus. XXI. 43 no. 194 (1906)[3].

Hab. Tenerife[1-3]: Puerto Orotava, ⊕ *Pinus canariensis*, 18. II, excl. 3. III – 10. IV. 1907 (*Wlsm.*), 11–14. IV. 1895 (*Hedemann*)[1], 21–29. IV. 1907 (*Wlsm.*).

A rare species, not met with by Mr. Eaton, and represented, so far as I am aware, only by von Hedemann's three original specimens, and one or two in Mr. White's collection. During a lucky half-hour, spent in the garden of the Hotel Humboldt, during a flying visit to Orotava, on the 18th of February, I found three pupae in the shoots of *Pinus canariensis*, all of which produced the moths in March and April. During a subsequent visit three other specimens were taken on the wing, in the same place, from the 21st to 29th of April. I have observed traces of the larvae in the pine-forests, to the south of Pedro Gil, but it does not appear to occur to the west of Guimar, where I searched the pines unsuccessfully.

65. (248) CROCIDOSEMA Z.

131. (1968) Crocidosema plebeiana Z.

n. syn. =*obscura* E. Wlstn.; =*blackburnii* Btl.[7]; =**signatana* Wlsm. (nec Dgl.).

Crocidosema plebejana Z. Isis, **1847**. 721–2 no. 283 (1847)[1]. *Steganoptycha obscura* E. Wlstn. Ann-Mag. NH. (5 s.). III. 341 (1879)[2]: Lp. St. Helena 28–8 (1879)[2]. *Crocidosema plebeiana* Meyr. Pr. Lin. Soc. N.S.W. VI. 659–60 (1881)[3]. *Steganoptycha *signatana* Wlsm. Tr. Ent. Soc. Lond. **1894**. 537, 541 no. 14 (1894)[4]. *Crocidosema plebeiana* Wlsm. Pr. Z. Soc. Lond. **1897**. 127 no. 174 (1897)[5]; Stgr-Rbl. Cat. Lp. Pal. II. 110 no. 1968 (1901)[6]; Wlsm. Fn. Hawaii. V. 675–6, 736, 752 no. 366, Pl. **10**·15 (1907)[7].

Hab. ASIA[6]—Ceylon: Pundaloya, 4000 ft., II. 1890 (*Green*)—Palestine: (*Tristram*)—Syria[6]. S–C. EUROPE[1, 6]: ⊕ *Althea rosea*[5]; *Lavatera arborea*[5]—France: Mentone, 13. III. 1893

(*Wlsm.*)—SPAIN: MALAGA: Malaga, 8. IV. 1901 (*Wlsm.*). N. AFRICA—MOROCCO: Tangier, 13. IV. 1901, 12. V. 1902 (*Wlsm.*) —ALGERIA: Biskra, 5-13. III. 1903 (*Wlsm.*). **Madeiras** [4]—MADEIRA [4]: The Mount (*Wollaston*) [4]. **Canaries**—TENERIFE: Guimar, 13. III. 1907; Puerto Orotava, ⊕ *Malva parviflora*, 29. IV, excl. 11–26. V. 1907; La Laguna, 23. V. 1907; Santa Cruz, 25. V. 1907 (*Wlsm.*). **St. Helena** [2]: Cleugh's Plain (*E. Wollaston*) [2]. WEST INDIES [5]. CENTRAL AMERICA [6]. SOUTH AMERICA [5]. AUSTRALIA [3]. HAWAIIA [7].

A single specimen (13575), in poor condition, to which I wrongly attributed the name "*Steganoptycha signatana* Dgl." (*l. c.* **4**), was collected in Madeira by Wollaston. Having now met with *Crocidosema plebeiana* at Santa Cruz, La Laguna, and Guimar, (where I also saw it in Mr. White's collection), and having bred two specimens from larvae feeding on *Malva parviflora*, at Puerto Orotava, I take this opportunity of correcting the previous error, while recording the species for the first time from Tenerife, and extending its range from Ceylon to St. Helena. I have examined the type of *Steganoptycha obscura* E. Wlstn. in the British Museum and find it to be *Crocidosema plebeiana* Z., a ♂ with the characteristic tuft.

66. (260·01) STREPSICRATES Meyr.

§ *STREPSICEROS* Meyr. Pr. Lin. Soc. NSW. VI. 678–9 (1882). STREPSICRATES Meyr. Tr. NZ. Inst. XX. 73 (1887); Wlsm. Pr. Z. Soc. Lond. **1891**. 506–7 (1892).

132. (2067·01) STREPSICRATES FENESTRATA, sp. n.

Antennae missing, except sufficient of the compressed, whitish cinereous, basal joints to identify the genus. *Palpi* erect, with very short terminal joint; much worn, but apparently fuscous externally. *Head* whitish cinereous. *Thorax* whitish cinereous along the centre, brownish fuscous at the sides. *Forewings* with a very deep costal fold, reaching to beyond the middle of the wing; dark brownish fuscous, slightly mottled with whitish cinereous, tending to indicate oblique, but slightly curved, transverse lines before the apex, reaching from costa to termen, and one reaching the dorsum before the tornus, but this latter appears to form the outer margin of the more intensely dark colouring which pervades the wing thence to the base, except along the dorsum; here is a large reduplicated patch of whitish cinereous, commencing at one-fourth, indented at its upper edge about the middle, and thence extending again nearly to the outer end of the fold; there is also a pale patch at the tornus—these are slightly sprinkled with pale brownish fuscous scales, usually in the form of narrow dorsal streaks; the cilia appear to be mottled with darker and paler alternations at the base. *Exp. al.* 15 mm. *Hindwings* semitransparent, subiridescent, brownish grey, with a conspicuous scaleless fenestrum below the base of the cubitus, reaching nearly to the origin of vein 2; cilia brownish grey. *Abdomen* brownish grey; anal tuft paler. *Legs* pale brownish cinereous.

Type ♂ (13525) Mus. Wlsm.

Hab. TENERIFE: Guimar (*White*).

A single ♂, given to me by Mr. White, is in extremely poor condition; I should certainly not have described it had it not been for the peculiar character of the fenestrum in the hindwing. It was taken from a series in his collection, which included more than one species. I certainly recognised *Crocidosema plebeiana* Z. among them, and there were others similar to the one here described.

(260) EUCOSMA Hb.

=*EPIBLEMA* Hb., Stgr-Rbl.

(2090·1) EUCOSMA SP. 198 Rbl.

Epiblema sp. Rbl. Ann. KK. Hofmus. XXI. 37–8, 43 no. 198 (1906)[1].

Hab. TENERIFE[1]: 1905, 1906 (*White*)[1].

Unnamed specimens in Mr. White's collection; not in good enough condition for identification. I did not meet with the genus *Eucosma* in Tenerife.

67. (257) THIODIA Hb.

=*SEMASIA* Stph., Stgr-Rbl.

133. (1980·1) THIODIA GLANDULOSANA, sp. n. (Plate LIII. fig. 2.)

Antennae brownish cinereous. *Palpi* varying from ochraceous to brownish fuscous. *Head* and *Thorax* brownish fuscous above; the tegulae paler, sometimes ochraceous. *Forewings* with the costa evenly arched, termen slightly sinuate; ochraceous, more or less suffused with brownish, or dark fuscous scaling, the markings indicated by black patches; in an ordinary variety the wing is much mottled and traversed by sinuous streaks, the costa being streaked and spotted throughout; a strong dorsal patch is indicated, coming from the base below the fold, angulated above the fold at one-third, and produced along the more or less spotted dorsum to an obliquely erect antetornal patch of the same colour, terminating a little below half the width of the wing; in some varieties a curved band of similar blackish patches descends from the middle of the costa, bending outward through the end of the cell, and attenuated to the apex, but this is sometimes quite obsolete; a narrow blackish line, broken into spots above the tornus, follows the termen before the ochraceous cilia, which are mottled with brown and blackish above the middle and at the apex, but always with a pale line along their base; in some varieties the upper edge of the dorsal patch and the lower half of the termen, as well as the base of the cilia about the tornus, are touched with shining white, some steely grey scales appearing on the dark patch and before the apex of the wing. *Exp. al.* 13–21 mm. *Hindwings* greyish fuscous; cilia paler, with a shade-line running through them. *Abdomen* greyish fuscous, anal tuft and *Legs* inclining to ochreous; hind tarsi faintly barred.

Type ♂ (99114); ♀ (99112); var. ♀ PT. (99113) Mus. Wlsm.

Hab. TENERIFE: Las Mercedes, 30. III. 1904 (*Eaton*), 19–29. V. 1907 (*Wlsm.*); La Laguna, ⊕ *Rhamnus glandulosa*, 19. V, excl. 6–23. VI. 1907 (*Wlsm.*). Thirty specimens.

The larva rolls the leaves of *Rhamnus glandulosa* and is common between La Laguna and Tegeste, and in the Mercedes Forest. It is an extremely variable species allied to *signatana* Dgl.

68. (261) LASPEYRESIA Hb.

=§ *GRAPHOLITHA* Tr., Stgr-Rbl. (nec Hb.).

134. (2168) LASPEYRESIA ADENOCARPI Rgt.

Grapholitha adenocarpi Rgt. Bull. Soc. Ent. Fr. XLIV. (5 s. V: **1875**). p. lxxiii no. 5 (1875)[1]: Ann. Soc. Ent. Fr. XLV. (5 s. VI: **1876**). 406–8 no. 4. Pl. **6** · 4 (1876[2]); Stgr-Rbl. Cat. Lp. Pal. II. 121 no. 2168 (1901)[3].

Hab. WC. ASIA—HALEB: Shar Devesy, 1893 (*Nat. Coll.*: *Leech*). S. EUROPE—SW. FRANCE: Dax, ⊕ *Adenocarpus parvifolius*[1-2], *Sarrothamnus scoparius*[2], excl. VI–IX[2]—S. SPAIN: CADIZ: Chiclana, 25. II. 1901: MALAGA: Malaga, 13. III. 1901: GRANADA: Granada, 5. V – 14. VI. 1901 (*Wlsm.*). **Canaries**—TENERIFE: IV. 1884 (*Leech*).

Two specimens were taken in Tenerife, in April 1884, by the late Mr. J. H. Leech, who gave them to me the following year. I did not meet with this species.

135. (2188) LASPEYRESIA NEGATANA Rbl.

=**salvana* Rbl. (nec Stgr.).

Grapholitha (*Phthoroblastis*) *?* **salvana* Rbl. Ann. KK. Hofmus. IX. 17, 88 no. 155 (1894)[1]. *Grapholitha negatana* Rbl. Ann. KK. Hofmus. XI. 121–2, 146 no. 171, Pl. **3** · 8 ♂ (1896)[2]: XXI. 43 no. 199 (1906)[3]: Stgr-Rbl. Cat. Lp. Pal. II. 122 no. 2188 (1901)[4].

Hab. TENERIFE[1-4]: La Laguna, 16. III. 1902 (*Eaton*), 30. V – 9. VI. 1907 (*Wlsm.*); Las Mercedes, 29. III. 1904 (*Eaton*); IV. 1884 (*Leech*)[1]; Guimar, 6. IV. 1907 (*Wlsm.*); Puerto Orotava, 14. IV. 1895 (*Hedemann*)[2].

Found flying somewhat plentifully, on one occasion only, about *Adenocarpus foliolosus*, above Guimar, in the direction of the Barranco del Rio, on April 6th; found again sparingly at La Laguna, at the end of May and the beginning of June.

69. (264) CYDIA Hb.

= *CARPOCAPSA* Tr., Stgr-Rbl.

136. (2257) CYDIA POMONELLA L.

136+a (2257+a) POMONELLA L.+POMONELLA L.

Phalaena Tinea pomonella L. Syst. Nat. (ed. X). I. 538 no. 270 (1758)[1]. *Carpocapsa pomonella* Stn., Godman's NH. Azores 106 no. 27 (1870)[2]; Meyr. Pr. Lin. Soc. NSW. VI. 657. (1881)[3]; Slngrld. Cornell Univ. Agr. Exp. Stn. Ent. Div. Bull. **142**. 3–60, fig. 126–146 (1898)[4]. *Cydia pomonella* Wlsm. Ann-Mag. NH. (7 s.). VI. 435 no. 1181 (1900)[5]. *Carpocapsa pomonella* Stgr-Rbl. Cat. Lp. Pal. II. 125–6 no. 2257 (1901)[6]. *Cydia pomonella* Frnld. Bull. US. Nat. Mus. **52**. 471 no. 5296 (1902)[7].

Hab. ASIA[5-6]. EUROPE[1-7]. AFRICA[4-6]. **Azores**[2]—TERCEIRA: (*Godman*)[2]. N-S. AMERICA[4-7]. AUSTRALIA[3]. NEW ZEALAND[3].

⊕ Apples, and other fruits, Walnuts, etc.

136+b (2257+b) POMONELLA L. + PUTAMINANA Stgr.

Carpocapsa putaminana Stgr. Stett. Ent. Ztg. XX. 232 no. 56 (1859)[1]. *Carpocapsa pomonella* L. + *putaminana* Stgr-Rbl. Cat. Lp. Pal. II. 126 no. 2257[a] (1901)[2]: Rbl. Ann. KK. Hofmus. XXI. 38, 44 no. 201 (1906)[3].

Hab. WC. ASIA[2]. S. EUROPE[1-2]. **Canaries**[3]—TENERIFE[3]: 1905 (*White*)[3].

I did not meet with this species: the typical form was recorded in 1870 as having been taken in the Azores.

70. (261·1) EUCELIS Hb.

137. (2197) EUCELIS MADERAE Wlstn.

Ephippiphora maderae Wlstn. Ann-Mag. NH. (3 s.). I. 120 (1858)[1]. *Grapholita maderae* Wkr. Cat. Lp. BM. XXX. 990 (1864)[2]. *Grapholitha maderae* Wlsm. Tr. Ent. Soc. Lond. **1894**. 537, 540 no. 11 (1894)[3]; Rbl. Ann. KK. Hofmus. IX. 17, 87–8 no. 154 (1894)[4]: XI. 121, 146 no. 170. Pl. **3**·8 ♂ (1896)[5]: XXI. 44 no. 200 (1906)[6]: Stgr-Rbl. Cat. Lp. Pal. II. 122 no. 2197 (1901)[7]: *Eucelis maderae* Wlsm. Ent. Mo. Mag. XXXIX. 214 (1903)[8].

Type ○ (no. XVIII) Mus. Br.

Hab. **Madeiras**[1-5, 8]—MADEIRA[1-5]: The Mount (*Wollaston*)[3], Monte, 1100 ft., 6. III. 1902 (*Eaton*); Funchal (*Wollaston*)[3], 14. IV. 1904 (*Eaton*); Caniçal, 21. IV. 1904 (*Eaton*); V. 1886 (*Leech*)[4]. **Canaries**[3-7]—TENERIFE[3-7]: Santa Cruz, 10. I. 1907 (*Wlsm.*); Guimar, 4. III – 4. IV. 1907 (*Wlsm.*); Puerto Orotava, 16–22. IV. 1895 (*Hedemann*)[5], 26. IV. 1907 (*Wlsm.*); IV. 1884 (*Leech*)[4]; Realejo, 25. IV. 1895 (*Hedemann*)[5].

Taken at Santa Cruz, Orotava, and Guimar, in January, March, and April, but not common.

138. (2197·2) EUCELIS MARRUBIANA, sp. n. (Plate LIII. fig. 4.)

= **indusiana* Rbl. (nec Z.).

Polychrosis ? indusiana Rbl. Ann. KK. Hofmus. XXI. 37, 43 no. 195 (1906)[1].

Antennae pale brownish grey. *Palpi* hoary grey, sprinkled with fuscous. *Head* and *Thorax* hoary grey, with some fuscous speckling; the latter with a slight, blackish-sprinkled, thoracic tuft posteriorly. *Forewings* greyish white, with pale olivaceous brownish suffusion, tending to indicate two transverse fasciae, one at one-third, bounding the outer side of an obscurely speckled and shaded basal patch, the other, in the middle, accompanied on its outer side by small spots of fuscous and blackish scaling, the intermediate pale space contains a narrow fluctuate line parallel to the equally sinuate outer edge of the first fascia; beyond the middle of the wing some blackish scales are sparsely sprinkled below the middle, near the central fascia, and again in a patch between the upper angle of the cell and the apex, this patch containing three or four black dots; the termen is narrowly shaded with olivaceous brownish, a narrow black line preceding the cilia; along the costa is a series of outwardly oblique brownish streaks, of varying sizes, with more or less sprinkling of black scales, some short dark streaks also along the dorsum; cilia greyish white, delicately sprinkled and shaded with brown and black. *Exp. al.* 8·5–13 mm. *Hindwings* brownish grey; cilia shining, paler, with a shade-line near their base. *Abdomen* hoary griseous. *Legs* hoary, the tarsi spotted above with fuscous.

Type ♀ (99051); ♂ (99052) *Guimar*, Mus. Wlsm.

Hab. S. FRANCE: Monte Carlo, 1. VI. 1889 (*Wlsm.*)—S. SPAIN: MALAGA: Malaga, 29. IV – 2. V. 1901 (*Wlsm.*). **Canaries**[1]—TENERIFE[1]: 1905 (*White*)[1]; Guimar, 4–25. III. 1907, ⊕ *Marrubium vulgare*, 14. III, excl. 21–24. III. 1907 (*Wlsm.*). Nineteen specimens.

Taken, and bred; very common on the top of the hill west of Guimar. The larva feeds on the seeds of *Marrubium*, the empty pupa-cases protruding conspicuously from the dry seed-vessels of the previous year.

This is the species which stands in Mr. White's collection, named by Prof. Rebel, "*Polychrosis ? indusiana* Z." In appearance it is undoubtedly extremely similar to *Polychrosis porrectana* Z., next to which Rebel (Stgr-Rbl. Cat. Lp. Pal. II. 109), following Zeller, places *indusiana*. The true *indusiana* Z. is however quite unlike *marrubiana* and *porrectana*. Anyone seeing the type of *indusiana* would at once place it next to *staticeana* Mill., from which indeed I am quite unable to separate it, and there is no doubt that Millière's name must fall as a synonym.

The following correction should be made in the European Lists :—

(1957) POLYCHROSIS INDUSIANA Z.

n. syn.=*staticeana* Mill.

Sericoris indusiana Z. Isis **1847**. 667 no. 274 [1]. *Penthina indusiana* HS. SB. Schm. Eur. IV. 232–3 no. 292 (1851), Pl. **50**·353 (1849) [2]. *Lobesia staticeana* Mill. Ic. Chen-Lp. II. 430–2. Pl. **95**·9–14 (1868) [3]. *Polychrosis staticeana* Stgr-Rbl. Cat. Lp. Pal. II. 109 no. 1957 (1901) [4]. *Polychrosis indusiana* Stgr-Rbl. Cat. Lp. Pal. II. 109 no. 1959 (1901) [5].

Hab. S. EUROPE [1-5]—SICILY: Catania, 3. VII. 1844 (*Zeller*) [1-2]—S. FRANCE [3-4]: ⊕ *Statice cordata* [3].

VII. TINEIDAE.

71. (435) STIGMELLA Schrank.

n. syn.=NEPTICULA Hdn., Z.; =*MICROSETIA (Stph.) Kby. (nec Stph-Wstwd.).

Type 1. *Phalaena Tinea anomalella* Goeze (Schrank 1802).

STIGMELLA Schrank Fn. Boica II. (2). 169 (1802).
1 (Type) *anomalella* Goeze [=*rosella* Schrank Fn. Boica II. (2). 139 no. 1890 (1802)].

When describing the genus *Stigmella*, Schrank inadvertently omitted to give the cross-reference to his type, which should have read thus :—

"Hieher gehört :
1. Stigmella rosella.
Tinea rosella *meiner Fauna n.* 1890."

It is however obvious that his remark "Ich meyne, dass die mir nicht hinlänglich bekannte Motte, welche die Rosenblätter gangweise minirt, hieher gehöre", refers to *rosella* Schrank (Rosenblatt G. 1890), having its "*Wohnort*: unter der Oberhaut der Rosenblätter, welche die Raupe gangweise minirt."

Schrank regarded his species as identical with that figured by Degeer (I. Pl. **31**·13–21), to which the name *anomalella* was given by Goeze, and Tutt [NH. Br. Lp. I. 206 (1899)] confirms Schrank's identification. It is therefore evident that *Stigmella* Schrank is the oldest geneonym for species hitherto placed in *Nepticula*.

Type 2. *Tinea aurella* F. (Tutt 1899).

NEPTICULA Hdn. Ber. Vers. Naturf. Mainz **1843**. 208; Z. Lin. Ent. III. 249, 301–3 (1848); Tutt NH. Br. Lp. I. 184–5 (1899); Stgr-Rbl., etc.

Type 3. *Nepticula microtheriella* Stn. (Kby. 1897).

MICROSETIA* (Stph.) Kby., Lloyd's NH., HB. Lp. V. 313–4. Pl. **108·8 (1897).

Kirby adopts *Microsetia* Stph., sinking *Nepticula* Z. as a synonym, overlooking that Westwood [Syn. Gen. Br. Ins. 112 (1840)] had cited as the type of *Microsetia* Stph., *stipella* (Hb. **20**·138) Stph. Ill. IV. 265, Wd. 1347 (=Wstwd. II. 212 no. 5. Pl. **112**·34)—apparently an *Aphelosetia*: but in any case *microtheriella* Stn. cannot be the type of *Microsetia* Stph.

139. (4303·1) Stigmella rubicurrens, sp. n.

Antennae steel-grey; eye-caps steely yellowish. *Head* black above. *Thorax* bronzy greyish. *Forewings* pale greenish bronzy greyish, a broad copper patch preceding the paler shining grey cilia. *Exp. al.* 4 mm. *Hindwings* and cilia steely grey. *Abdomen* fuscous. *Legs* steely grey.

Type ♀ (14160) Mus. Wlsm.

Hab. Tenerife: La Laguna, ⊕ *Rubus*, 8. III, excl. 26. III. 1904 (*Eaton*). Unique.

This differs from *fletcheri* Tutt in the distinctly copper, not purplish, patch at the apex.

Mr. Eaton bred a single specimen from a larva found mining a bramble leaf in the barranco below La Laguna, at about 1700–1600 ft., on March 8th. Mines, obviously narrower than those of *aurella* F., occurred on Bramble at Puerto Orotava, but I failed to breed the species. This is probably the same as the larva found by von Hedemann at Orotava, mining Bramble, in April 1895, and recorded by Rebel as *Nepticula sp.* [Ann. KK. Hofmus. XI. 143, 147 no. 220 (1896): XXI. 44 no. 245 (1906)]. A single specimen (99173), taken at Puerto Orotava, 14. V. 1907 (*Wlsm.*), is possibly a worn example of this species, but it shows only a slight coppery tint, instead of the distinct copper patch of the bred specimen.

140. (4333) Stigmella aurella F.

Tinea aurella F. Syst. Ent. 666 no. 65 (1775)[1]. *Nepticula aurella* Tutt NH. Br. Lp. I. 228–33 (1899)[2]; Stgr-Rbl. Cat. Lp. Pal. II. 223 no. 4333 (1901)[3].

Hab. EUROPE[1-3]: *Rubus fruticosus*[2-3]. N. AFRICA[2-3]—Morocco: Tangier, 10. IV. 1902 (*Wlsm.*). **Canaries**—Tenerife: Guimar, 1. III – 14. IV. 1907 (*Wlsm.*); La Laguna, 7–8. III. 1904 (*Eaton*); Villa Orotava, ⊕ *Rubus fruticosus*, 19. II, excl. 17–30. III. 1907 (*Wlsm.*).

First received from Mr. Eaton, who met with it at La Laguna; I took it at Guimar, and bred it from *Rubus fruticosus* at Villa Orotava, where the larvae were abundunt.

141. (4368·1) Stigmella staticis, sp. n.

Antennae blackish; eye-caps pale ochraceous. *Head* rust-brown. *Thorax* and *Forewings* black, minutely irrorated with pale leaden grey; cilia pale leaden grey, with black speckling.

Exp. al. 3–4·25 mm. *Hindwings* and cilia pale leaden grey. *Abdomen* grey. *Legs* pale grey.

Type ♀ (99201); ♂ (99202) Mus. Wlsm.

Hab. TENERIFE: Puerto Orotava, ⊕ *Statice pectinata*, 4. V, excl. 29. V – 21. VI. 1907; La Laguna, 20. V. 1907. Thirteen specimens.

Perhaps most nearly allied to *helianthemella* HS., but the head is ochreous, and there is no pale fascia in either sex: the antennae are long, and there is no dark dividing line in the cilia.

Bred from larvae mining the leaves of *Statice pectinata*: the green larva, making small, tortuous, mines in the little leaves, is fairly abundant, but very inconspicuous; the cocoon is whitish. The mines were collected at Puerto Orotava; a single specimen taken on a table in the hotel at La Laguna probably escaped from my bottles.

142. (4368·2) STIGMELLA SANCTAECRUCIS, sp. n.

Antennae greyish fuscous, paler beneath; eye-caps dull ferruginous, speckled with fuscous. *Head* dull ferruginous. *Thorax* greyish fuscous. *Forewings* pale cinereous, profusely speckled with greyish fuscous, almost entirely obliterating the paler ground-colour, which is confined to the bases of the rather coarse scales, but shows more clearly where the scales become lengthened, as in the cilia. *Exp. al.* 4·5–5 mm. *Hindwings* and cilia very pale greyish. *Abdomen* greyish fuscous. *Legs* pale cinereous.

Type ♂ (99214) Mus. Wlsm.

Hab. TENERIFE: Santa Cruz, 15–17. I. 1907. Six specimens.

I found this species at Santa Cruz, only among plants of *Lavandula abrotanoides*, on which I noticed mines that appeared to differ from those of *Perittia lavandulae* Wlsm. (*ante*, p. 971 no. 83): they were more slender, and more tortuous, and probably belonged to a *Stigmella*.

143. (4378·1) STIGMELLA MICROMERIAE, sp. n.

Antennae grey; eye-caps silvery white. *Head* yellowish. *Forewings* steely white, profusely sprinkled with coarse dark grey, or fuscous, scales; a straight silvery white transverse fascia, at two-thirds from the base, is sometimes slightly interrupted by a few of the dark scales; cilia steely whitish, with a slight sprinkling at their base. *Exp. al.* 3·5–4 mm. *Hindwings* and cilia pale steely grey. *Abdomen* grey. *Legs* greyish.

Type ♀ (99220); ♂ (99221) Mus. Wlsm.

Hab. TENERIFE: Guimar, 14. III – 12. IV, ⊕ *Micromeria varia*, 25. II, excl. 1–9. IV. 1907. Twenty.two specimens.

The larva feeds on *Micromeria varia*, and I think also on *Micromeria origanifolia*, making small tortuous mines. It is decidedly common.

144. (4416·1) STIGMELLA JUBAE, sp. n. (Plate LIII. fig. 7.)

Antennae yellowish, delicately annulate with black; eye-caps whitish. Head bright yellow. *Thorax* black. *Forewings* white, with a broad black central fascia through which the ground-colour is visible only in small specks; a black basal patch, angulated outward in the middle, leaving only a narrow, curved, or angulated, white fascia between it and the median band, and a black patch occupying the whole apex and termen, the ground-colour showing before it in a narrow, white, rather oblique, bar, sometimes divided into two nearly opposite spots; this patch also shows some pale speckling; cilia whitish at the apex and termen, with a line of black scales running through them; greyish on the dorsum. *Exp. al.* 4·5–5·5 mm. *Hindwings* and cilia pale grey. *Legs* black, with white speckling.

Type ♀ (99119); ♂ (99121) Mus. Wlsm.

Hab. TENERIFE: Santa Cruz, ⊕ *Euphorbia regis-jubae*, 4. II, excl. 8–17. III. 1907; Guimar, 9. III – 10. IV, ⊕ *Euphorbia regis-jubae*, 9. III, excl. 11–15. V. 1907. Eight specimens.

The larva makes narrow, tortuous, mines in the leaves of *Euphorbia regis-jubae*, and is not uncommon near Santa Cruz, and near Guimar, in February and March; like that of *euphorbiella* Stn., it is pale yellowish. The species is nearly allied to the South European *euphorbiella* Stn., but differs in the white, not creamy, ground-colour being much more obscured by black scaling.

145. (4416·2) STIGMELLA NIGRIFASCIATA, sp. n.

Antennae greyish; eye-caps white. *Head* greyish, with some white sprinkling. *Thorax* fuscous. *Forewings* white, with a smoky, ill-defined, basal patch, extending to one-third and speckled with black; a straight, rather narrower, median fascia, also thickly black-speckled, and an apical patch of the same colour including the cilia, except at their pale greyish outer ends. *Exp. al.* 4 mm. *Hindwings* and cilia pale greyish. *Abdomen* fuscous. *Legs* whitish, spotted with fuscous.

Type ♂ (99242) Mus. Wlsm.

Hab. TENERIFE: Santa Cruz, 14. II. 1907. Two specimens, in excellent condition.

Much smaller and more fasciated than *jubae*, but not unlike it in colour.

146. (4418·1) STIGMELLA RIDICULOSA, sp. n.

Antennae pale fawn; eye-caps fawn-whitish. *Head* fawn-whitish, inclining to yellowish. *Thorax* fawn-whitish. *Forewings* fawn-whitish, profusely speckled with fawn-brown, this colour confined to the tips of the scales; cilia fawn-whitish, with very slight speckling. *Exp. al.* 4–4·5 mm. *Hindwings* very pale greyish; cilia fawn-whitish. *Abdomen* brownish grey. *Legs* fawn-whitish.

Type ♀ (99255); ♂ (99257) Mus. Wlsm.

Hab. TENERIFE: Santa Cruz, 8–14. II. 1907; Guimar, ⊕ *Lotus sessilifolius*, 6. III, excl. 6–8. IV. 1907. Eighteen specimens.

An inconspicuous species belonging to the group of *cistivora* Peyr. The larva occurs at Santa Cruz, and Guimar, mining the minute leaflets of *Lotus sessilifolius*. Although very minute and inconspicuous, it is easily disturbed among its food-plant, and is not difficult to breed, if the obviously-mined leaves are collected without regard to the presence or absence of the larvae.

72. (431) BUCCULATRIX Z.

147. (4246) BUCCULATRIX CHRYSANTHEMELLA Rbl.

Bucculatrix chrysanthemella Rbl. Ann. KK. Hofmus. XI. 142, 147 no. 219 (1896)[1]: XXI. 44 no. 244 (1906)[2]: Stgr-Rbl. Cat. Lp. Pal. II. 219 no. 4246 (1901)[3].

Hab. TENERIFE[1-3]: Guimar, 28. II. 1907, ⊕ *Chrysanthemum frutescens*, 27. II, excl. 7. III – 7. IV. 1907 (*Wlsm.*); Puerto Orotava[1], 23. IV – 10. V. 1907 (*Wlsm.*), ⊕ *Chrysanthemum frutescens*, excl. 25–28. IV. 1895 (*Hedemann*)[1].

Common on *Chrysanthemum frutescens*, at Santa Cruz and Guimar; I bred it from larvae and cocoons found on this plant.

148. (4246·1) BUCCULATRIX CANARIENSIS, sp. n.
(Plate LIII. fig. 10.)

Antennae dirty whitish, transversely barred above with greyish fuscous. *Head* greyish fuscous, hoary whitish at the sides. *Thorax* whitish, thickly sprinkled with fuscous. *Forewings* whitish, profusely sprinkled with greyish fuscous, and with some blackish scaling; the pale ground-colour is chiefly apparent in a streak, commencing at the base below the costa and extending to the end of the cell, ill-defined, but somewhat dilated about its middle, where there is a small black dot at its upper, and another at its lower edge, some black scaling running along the fold between this and the base; there is also a sprinkling of black scales around the end of the cell, and a double line of the same in the terminal cilia; dorsal cilia pale cinereous. *Exp. al.* 7–8 mm. *Hindwings* shining, pale stone-grey; cilia pale brownish cinereous. *Abdomen* shining, pale cinereous. *Legs* pale brownish cinereous, with faintly spotted tarsi.

Type ♂ (99276); ♀ (99279) Mus. Wlsm.

Hab. TENERIFE: Santa Cruz, 11–16. II. 1907; Guimar, 28. II – 13. III. 1907; La Laguna, 9. VI. 1907. Sixteen specimens.

This species occurs at Santa Cruz, Guimar, and La Laguna, and probably everywhere where *Artemisia canariensis* is found; I did not actually breed it, but I found one or more larvae, and saw empty cocoons upon the plant. I have so far been unable to identify it with any known European species: it is an obscure insect, with no clearly defined markings—my specimens are in very good condition.

149. (4256·1) BUCCULATRIX PHAGNALELLA, sp. n.
(Plate LIII. fig. 9.)

Antennae cinereous, faintly barred with fuscous. *Head* and *Thorax* whitish, the former with a strong admixture of dark rust-brown scales, especially on the middle of the crown; face and eye-caps white beneath. *Forewings* white, thickly besprinkled with fuscous and fawn-brown scaling; a blackish blotch, on the middle of the dorsum, is produced outward at its upper edge, and diluted in the direction of the apex, meeting, beyond the end of the cell, a corresponding shade bent downward from the middle of the costa, along which it can be traced narrowly to the base; the white ground-colour is always more clearly exhibited alongside of the darker shades and patches; apical cilia white, sprinkled with black scales, dorsal cilia greyish. *Exp. al.* 7–8 mm. *Hindwings* shining, pale grey; cilia brownish grey. *Abdomen* grey. *Legs* brownish grey.

Type ♂ (99292); ♀ (99293) Mus. Wlsm.

Hab. TENERIFE: Guimar, 23–30. III. 1907, ⊕ *Phagnalon saxatile*, 27. II, excl. 24. III – 12. IV. 1907. Twenty-two specimens, nineteen bred.

Nearest to *fatigatella* Hdn., but the costal shade is less pronounced, and more limited to the costa, tending to spread, not toward the dorsum, but rather toward the tornus. The larva is common at Guimar on *Phagnalon saxatile*.

73. (431·1) EREUNETIS Meyr.

EREUNETIS Meyr. Pr. Lin. Soc. NSW. V. 258 (1880): Tr. NZ. Inst. XX. 92 (1888): Pr. Lin. Soc. NSW. (2 s.). VII. 480, 562–3 (1893).

150. (4275·1) EREUNETIS UNDOSA, sp. n.

Antennae dark brown. *Palpi* slender, drooping; brownish. *Head* white, a brownish band above between the eyes. *Thorax* white; tegulae streaked with brown. *Forewings* dark chocolate-brown, with a broad white band along the dorsum, extending from base to apex, but almost interrupted at the tornus by overflow of the dark brown slightly overlapping the end of the fold; there is also a slight overlap at one-third from the base, while the white band projects a little across the fold at two-thirds; apex white, with a few brown scales; cilia white, with some greyish tinge about the tornus. *Exp. al.* 13 mm. *Hindwings* shining, pale steely grey; cilia brownish grey. *Abdomen* steely grey; flattened at the base, with long projecting ovipositor. *Legs* yellowish white; hind tibiae with long hairs above.

Type ♀ (99174) Mus. Wlsm.

Hab. TENERIFE: Puerto Orotava, 2. V. 1907. Unique.

Allied to *seminivora* Wlsm. [Ind. Mus. Notes IV. 107. Pl. 7 · 2a–d (1899)], which differs in its brown face and pale antennae.

74. (470) OENOPHILA Stph.

=† *OINOPHILA* Stph., Stgr-Rbl.

151. (4621) OENOPHILA V-FLAVA Hw.

Gracillaria v-flava Hw. Lp. Br. 530 no. 14 (1828)[1]. *Oinophila flava* Stn. Ann-Mag. NH. (3 s.). III. 214 no. 24 (1859)[2]. *Oenophila v-flavum* Wlsm. Tr. Ent. Soc. Lond. **1894**. 537, 542 no. 24 (1894)[3]. *Oinophila v-flavum* Rbl. Ann. KK. Hofmus. XI. 125, 146 no. 183 (1896)[4]: XXI. 44 no. 254 (1906)[5]: Stgr-Rbl. Cat. Lp. Pal. II. 240 no. 4621 (1901)[6].

Hab. EUROPE[1-4, 6]: ⊕ on fungus in cellars, on corks. **Madeiras**[2-4, 6]—MADEIRA[2-4, 6]: (*Wollaston*)[2]; Funchal, 27. IV. 1904 (*Eaton*). **Canaries**[4-6]—TENERIFE[4-6]: Tacaronte, 18–28. II. 1907 (*Wlsm.*); La Laguna, 1800 ft., 22. II. 1904 (*Eaton*), 2100–500 ft., 17. III. 1902 (*Eaton*), 30. V. 1907 (*Wlsm.*); Guimar, 6. III. 1907 (*Wlsm.*), 23. III. 1904 (*Eaton*), 14. IV. 1907 (*Wlsm.*); Puerto Orotava[4], 13. III. 1904 (*Eaton*), 23–30. IV. 1895 (*Hedemann*)[4], 24. IV – 2. V. 1907 (*Wlsm.*).

Haworth's idionym "*v-flava*" has been changed to "*v-flavum*," despite its acceptance, with explanation of derivation, by the Entomological Societies of Oxford and Cambridge [Acc. List Br. Lp. 90 (1858)], and Stephens' genus is still written "*Oinophila*," although corrected to "*Oenophila*," by the same Societies (*l. c.*). Smith (Smaller Lat-Eng. Dict. 596) writes of the letter V: "V, *indecl. n.* or (litera, *subaud.*) *f.*" Haworth's idionym is therefore correctly formed, and the alteration unnecessary.

152. (4621·1) OENOPHILA NESIOTES, sp. n.
(Plate LIII. fig. 11.)

Antennae pale olivaceous brownish, with a bronzy sheen above; pale yellowish beneath. *Palpi* short, divergent; pale ochreous, a brownish shade on the outer side of the terminal joint. *Head* ochreous, with a raised rust-brown crest between the antennae; face shining, pale yellowish ochreous. *Thorax* ochreous. *Forewings* dark olivaceous brown, with two shining, pale ochreous, transverse fasciae; the first, at one-third from the base, angulated outward at the middle, the angle produced outward along the cell, forming a continuous bar reaching to the middle of the outer fascia, at three-fourths from the base, which is inverted obliquely from costa to dorsum; this median bar is continued, in a diffused and rather obscure band, from the inner side of the first fascia to the base, leaving the dark ground-colour broader above it, and narrower below it along the margins—it is also continued beyond the outer fascia, with slight interruption, along the termen and through the cilia around the apex; cilia smoky brownish grey; underside strongly iridescent, with scattered metallic scales on a bronzy fuscous ground. *Exp. al.* 8–9 mm. *Hindwings* bronzy brownish, with a few iridescent metallic scales about the apex; cilia brownish grey. *Abdomen* greyish fuscous, richly sprinkled with iridescent metallic scales. *Legs* brownish grey, the tarsi faintly spotted with pale ochreous.

Type ♂ (99176); ♀ (99177) Mus. Wlsm.

Hab. TENERIFE: La Laguna, 23. V. 1907. Twenty-four specimens.

A single specimen of this species would certainly be regarded as a variety of *v-flava* Hw., but the evidence pointing to the contrary is so strong that it must at least command attention. Should it in future be decided, by someone more fully acquainted with the larval history of both forms, that they are not consistently different and separable, the name *nesiotes* will sink as a varietal synonym. In general appearance the new species is rather more slender and elongate—the forewings longer in proportion to their width. In markings it differs in the invariable presence of a connecting bar along the cell, between the two pale transverse fasciae: this arises from the angulate outer edge of the first fascia, and is also more or less traceable on the basal side of the fascia, where it is sometimes quite as conspicuous as beyond it. In *v-flava*, the angle of the >-shaped fascia is often produced outward, and is occasionally traceable as far as the second, or outer, fascia, but among all the European and British specimens that I have seen there have been none in which the central pale longitudinal bar is produced inward to the base of the wing. I brought home 28 specimens of *v-flava*, from various localities in Tenerife, and have 5 received from Mr. Eaton: I have also 5 specimens from Madeira. None of these possess the characters of *nesiotes*, although many of them were selected from a larger number of captures on account of some tendency to variation: they cannot be separated from European specimens of *v-flava*. Of *nesiotes* I have 24 specimens, all taken in one spot, about ten yards square, in brushwood under a clump of fir-trees, north of the road between La Laguna and Tacaronte, about two or three miles from the former. In that spot they were flying in hundreds: I netted twenty at a time, and could easily have taken a thousand, or more, had I wished to do so. A search for larvae proved that they must have been feeding between layers of dead leaves on the ground: there were signs of web and frass, and the moths were dislodged in plenty as the leaves were turned over, but I was somewhat hurried and did not actually find any larvae. The typical *v-flava* did not occur among them, nor could I find it anywhere near the spot.

75. (433) OPOGONA Z.

153. (4277) OPOGONA PANCHALCELLA Stgr.

Opogona panchalcella Stgr. Berl. Ent. Zts. XIV. 325 no. 110 (1870)[1]; Chr. Hor. Soc. Ent. Ross. XII. 230 (1876)[2]; Stgr. Hor. Soc. Ent. Ross. XV. 419 (1880)[3]: Stgr-Rbl. Cat. Lp. Pal. II. 220 no. 4277 (1901)[4].

Hab. SE. EUROPE[1-4]—RUSSIA[1-4]: ASTRACHAN: Sarepta[1, 3-4], 3. VII. 1867 (*Christoph*); DAGHESTAN: Derbent[2-3], 2. VII. 1870 (*Christoph*). WC. ASIA[2-4]—TRANSCAUCASIA[2-4]: Kasumkent[2-3]; Lenkoran[2]—LYDIA[3-4]: Smyrna[3]. N. AFRICA—ALGERIA: Hammam-es-Salahin, 3–15. IV. 1904 (*Wlsm.*); Biskra, 8–21. IV. 1903 (*Wlsm.*); Bône, 30. IV. 1896 (*Eaton*); Le Tarf, 2. VII. 1896 (*Eaton*). **Canaries**—TENERIFE: Santa Cruz, 2. I. 1907 (*Wlsm.*).

A single specimen of *Opogona panchalcella* was taken at Santa Cruz, 2. I. 1907, flying at dusk near a field in which Sorghum, or maize, had probably been grown: I am also able to record this species from Algeria.

76. (449) SETOMORPHA Z.

=**Lindera* Rbl. (nec Blanch.).

154. (4494) SETOMORPHA INSECTELLA F.

n. syn. = *rutella* Z. ♂ ♀; = *rupicella* Z. ♂; = *operosella* Z. ♀; = *inamoenella* Z. ♂; = *ruderella* Z. ♂; = *multimaculella* Chmb. ♂; = *dryas* Btlr. ♀; = *corticinella* Snln. ♂ ♀; = (**bogotatella* Alphk. ♀—nec Wkr.); = *discipunctella* Rbl. ♂ ♀.

Tinea insectella F. Ent. Syst. III. (2). 303 no. 72 (1794)[1]: Sppl. Ent. Syst. 489 no. 47 (1798)[2]. *Setomorpha rutella* Z. Lp-Micr. Caffr. 94–5 (1852)[3]: Hndl. Kngl. Vet-Ak. **1852**. 94–5 (1854)[3]. *Setomorpha rupicella* Z. Lp-Micr. Caffr. 95–6 (1852)[4]: Hndl. Kngl. Vet-Ak. **1852**. 95–6 (1854)[4]. *Setomorpha rutella* Wkr. Cat. Lp. BM. XXIX. 708 (1864)[5]; Z. VH. Z-B. Ges. Wien XXIII: **1873**. 223 (1873)[6]. *Setomorpha rupicella* Z. VH. Z-B. Ges. Wien XXIII: **1873**. 223 (1873)[7]. *Setomorpha operosella* Z. VH. Z-B. Ges. Wien XXIII: **1873**. 223–4 (1873)[8]. *Setomorpha inamoenella* Z. VH. Z-B. Ges. Wien XXIII: **1873**. 224–5 (1873)[9]. *Setomorpha ruderella* Z. VH. Z-B. Ges. Wien XXIII: **1873**. 225 (1873)[10]. *Setomorpha rutella* Z. Hor. Soc. Ent. Ross. XIII. 206 (1877)[11]. *Gelechia multimaculella* Chmb. Bull. US. GG. Surv. IV. 89–90, 145 (1878)[12]. *Setomorpha operosella* Chmb. Bull. US. GG. Surv. IV. 162 (1878)[13]. *Setomorpha inamoenella* Chmb. Bull. US. GG. Surv. IV. 162 (1878)[14]. *Setomorpha ruderella* Chmb. Bull. US. GG. Surv. IV. 162 (1878)[15]. *Setomorpha rutella* Wlsm. Tr. Ent. Soc. Lond. **1881**. 274, 287 (1881)[16]. *Chrestotes dryas* Btlr. Ann-Mag. NH. (5 s.). VII. 401 no. 39 (1881)[17]. *Gelechia multimaculella* Hgn. Pap. IV. 99 (1884)[18]. *Setomorpha corticinella* Snln. Tijd. Ent. XXVIII. 24–5 no. 10. Pl. **2** · 12 ♂–15 ♀ (1885)[19]. *Setomorpha rutella* Snln. Tijd. Ent. XXVIII. 24 (1885)[20]. *Setomorpha *bogotatella* Alphk. Mém. Lp. V. 231 no. 55 (1889)[21]. *Setomorpha rutella* Wlsm. Tr. Ent. Soc. Lond. **1891**. 81–2. Pl. **7** · 73 ♀ (1891)[22]; Cotes Ind. Mus. Notes II. 9–10 (1891)[23]. *Setomorpha operosella* Riley, Smith's List Lp. Bor-Am. 96 no. 5134 (1891)[24]. *Setomorpha inamoenella* Riley, Smith's List Lp. Bor-Am. 96 no. 5135 (1891)[25]. *Seto-*

morpha ruderella Riley, Smith's List Lp. Bor-Am. 96 no. 5136 (1891)[26]. *Gelechia multimaculella* Riley, Smith's List Lp. Bor-Am. 96 no. 5414 (1891)[27]. *Setomorpha rupicella* Wlsm. Pr. Z. Soc. Lond. **1891**. 511, 544 no. 48 (1892)[28]. *Setomorpha discipunctella* Rbl. Ann. KK. Hofmus. VII. 267–8, 283 no. 46. Pl. **17** · 16 ♀ (1892)[29]. **Lindera* **bogotatella* Rbl. Ann. KK. Hofmus. VII. 267, 268, 283 no. 47 (1892)[30]. *Setomorpha operosella* Rbl. Ann. KK. Hofmus. VII. 268 (1892)[31]. *Setomorpha rutella* Rbl. Ann. KK. Hofmus. VII. 268 (1892)[32]. *Setomorpha corticinella* Rbl. Ann. KK. Hofmus. VII. 268 (1892)[33]. *Setomorpha rutella* Cotes Ind. Mus. Notes II. 164 no. 152 (1893)[34]. *Setomorpha discipunctella* Rbl. Ann. KK. Hofmus. IX. 17 no. 159 (1894)[35]. **Lindera* **bogotatella* Rbl. Ann. KK. Hofmus. IX. 17 no. 160 (1894)[36]. *Setomorpha* **bogotatella* White, Bfl. & Moths Teneriffe 95 no. 19 (1894)[37]. *Setomorpha discipunctella* Rbl. Ann. KK. Hofmus. XI. 122–3, 146 no. 175 (1896)[38]. *Setomorpha rutella* Rbl. Ann. KK. Hofmus. XI. 123 (1896)[39]. **Lindera* **bogotatella* Rbl. Ann. KK. Hofmus. XI. 146 no. 176 (1896)[40]. *Setomorpha rupicella* Wlsm. Pr. Z. Soc. Lond. **1897**. 168 no. 281 (1897)[41]. *Setomorpha discipunctella* Rbl. Ann. KK. Hofmus. XIII. 377, 381 no. 189 (1899)[42]. **Lindera* **bogotatella* Rbl. Ann. KK. Hofmus. XIII. 381 no. 190 (1899)[43]. *Setomorpha discipunctella* Stgr-Rbl. Cat. Lp. Pal. II. 233 no. 4494 (1901)[44]. *Plutella* (?) *multimaculella* Busck Jr. N-Y. Ent. Soc. X. 97 (1902)[45]; Dyar Bull. US. Nat. Mus. **52**. 492 no. 5509 (1902)[46]. *Setomorpha operosella* Dyar Bull. US. Nat. Mus. **52**. 575 no. 6549 (1902)[47]. *Setomorpha inamoenella* Dyar Bull. US. Nat. Mus. **52**. 575 no. 6550 (1902)[48]. *Setomorpha ruderella* Dyar Bull. US. Nat. Mus. **52**. 575 no. 6551 (1902)[49]. *Setomorpha rutella* [de Niéc.] Ind. Mus. Notes V. 201–2 (1903)[50]; Dietz Tr. Am. Ent. Soc. XXXI. 14–15 (1905)[51]. *Semiota operosella* Dietz Tr. Am. Ent. Soc. XXXI. 18–19, 91 (1905)[52]. *Semiota inamoenella* Dietz Tr. Am. Ent. Soc. XXXI. 18, 19, 91. Pl. **6** · 4 ♂ (1905)[53]. **Lindera* **bogotalella* Rbl. Ann. KK. Hofmus. XXI. 24 no. 7 (1906)[54]. *Setomorpha discipunctella* Rbl. Ann. KK. Hofmus. XXI. 24, 40, 44 no. 246 (1906)[55]. *Setomorpha operosella* Busck Pr. US. Nat. Mus. XXX. 734–5 fig. 9 ♂–10 ♀ (1906)[56]. *Setomorpha rupicella* Wlsm. Fn. Haw. I. 726 (1907)[57]. *Setomorpha discipuntella* Wlsm. Fn. Haw. I. 726 (1907)[58]. *Setomorpha dryas* Wlsm. Fn. Haw. I. 726 no. 434 (1907)[59]. *Setomorpha rutella* Wlsm. Fn. Haw. I. 754 no. 434 (1907)[60].

Hab. HAWAIIA[17, 59]—OAHU: Honolulu[17, 59]—HAWAII: Kaawaloa, Kona 1500 ft., VI[59]. N. AMERICA (UNITED STATES)[8–10, 12–15, 18, 24–7, 31, 45–9, 52–3, 56]—TEXAS[8–10, 18, 46, 52–3] (= " Mass.")[47–9]: BOSQUE CO.[12]: Waco[13]—KANSAS[52]. C. AMERICA—MEXICO: GUERRERO: Amula, 6000 ft., VIII (*H. H. Smith*)—GUATEMALA: Balheu (Vera Paz, *Champion*); San Gerónimo (*Champion*)—COSTA RICA: Irazu, 6–7000 ft. (*Rodgers*). S. AMERICA[41, 57]—BRAZIL[41, 57]: Pará, X–XII[41]—COLOMBIA: Bogotá (*Nolcken*). WEST INDIES[4, 7, 28, 41, 57]—CUBA[4, 7, 28, 41]: Havannah [4, 28, 41]—JAMAICA: Moneague, 5. I. 1905 (*Wlsm.*); Runaway Bay, 23. II. 1905 (*Wlsm.*). **Canaries** [21, 29–30, 35–8, 40, 42–4, 54–5]—TENERIFE [21, 29–30, 35–8, 40, 42–4, 54–5]: Santa Cruz, XII. 1897 (*Hintz*) [42], 8–31. I. 1907 (*Wlsm.*); Guimar, 6. III – 18. IV. 1907 (*Wlsm.*); Puerto Orotava, 1896 (*Douglas-Crompton*), 11. III. 1904 (*Eaton*), 12. IV. 1895 (*Hedemann*) [38]; Agua Mansa, 30. VII. 1889 (*Simony*) [29]. AFRICA [1–3, 5–6, 11, 16, 20, 32, 39, 41]: in Insectis (*Bosc*) [1–2] —SIERRA LEONE: ⊕ in moss, excl. 24. VIII – 13. IX. 1895 (*Clements*) —GOLD COAST: Accra (*Carter*)—CONGO: Kasongo, ⊕ "in muscular fibre, on skull of Hippopotamus collected by Dr. Todd," excl. 18. IX. 1905 (*Newstead*) — CAFFRARIA [3, 11]: Limpopo-Gariep [3, 11]. ASIA [19, 23, 33–4, 50]—INDIA [23, 34, 50]: Calcutta [23, 34, 50], Aliwal [50], ⊕ in blanketing, excl. 20–29. XII [50]—CEYLON: ⊕ "bred from moths received from Ceylon," excl. 15. IX. 1899 (*Burrows*) —ASSAM: Margherita, 1889 (*Doherty*)—CELEBES [19, 33]: Saleijer [19]; Makassar [19]; Maros [19]. AUSTRALIA—QUEENSLAND: Toowong, 1896 (*Dodd*).

Types ♂ ♀ : *rutella* Z. ♂ ♀ (Mus. Stockholm; ♀ Mus. Wlsm.); *rupicella* Z. ♂ (Mus. Wlsm.); *operosella* Z. ♀, *inamoenella* Z. ♂, *ruderella* Z. ♂, and *multimaculella* Chmb. ♂ (Mus. Cambr-Mass.); *dryas* Btlr. ♀ (Mus. Br.).

A careful comparison of the type of *rutella* Z., with all the specimens of *Setomorpha* in my possession, shows that in the ♂ ♂ no difference can be detected sufficient to separate the five supposed species described from Caffraria, Cuba, the United States, Celebes, and Tenerife respectively.

Busck [Pr. U-S. Nat. Mus. XXX. 734–5 (1906)] has published the synonymy of the North American form, and this must now be combined with that of our Tenerife insect. I possess a long series of *rutella* Z. from Sierra Leone, bred from "moss," 24. VIII – 13. IX. 1895, by Dr. W. G. Clements (to whom I am indebted for this and other valuable material); there is absolutely no difference between these and the Tenerife specimens. I have also specimens bred, in Liverpool and at Merton, from muscular fibre attached to the skull of a Hippopotamus obtained by Dr. Todd at Kasongo (Congo: 5° S.)—for these I am indebted to Mr. R. Newstead. In India the larva has been found destructive to bales of country blanketing [Ind. Mus. Notes II. 9–10 (1891): V. 201–2 (1903)], and I have a specimen bred in England, by the Rev. C. R. N. Burrows, "from moths received from Ceylon." Dr. Clements' experience seems somewhat inconsistent with these records, but it is possible that the "moss" referred to by him may have been used for packing woollen goods, or skins, or may have contained an admixture of woollen rubbish; I am however without data on this subject. I have no ♂ of *corticinella* Snln. (Celebes), but this has been figured by Snellen and agrees with those already mentioned; I cannot regard this or *rupicella* Z. (Cuba) as distinct from *rutella* Z. *Setomorpha tineoides* Wlsm. [Pr. Z. Soc. Lond. **1886**. 465. Pl. **41** · 8 (1886)], having forewings 12 veins, all separate, and hindwings 8 veins, all separate, must be removed from

Setomorpha and referred to *Amydria* Clms. *Setomorpha grenadella* Wlsm. [Pr. Z. Soc. Lond. **1897**. 168–9, no. 282 (1897)] has strongly developed, folded, maxillaries and must be placed in *Dendroneura* Wlsm. The genus *Setomorpha* Z. is thus regarded as consisting of the single species *insectella* F., of which the synonymy is given above.

There seems little doubt that Fabricius described *rutella* Z. under the name *insectella*: in his description "posticæ" appears to be used in the sense of "postice" (possibly a misprint) and to apply to the forewings.

77. (475) DYSMASIA HS.

155. (4644) Dysmasia insularis Rbl.

Dysmasia insularis Rbl. Ann. KK. Hofmus. XI. 125–6, 146 no. 184. Pl. **3**·9 ♂ (1896)[1]: XXI. 44 no. 257 (1906)[2]: Stgr-Rbl. Cat. Lp. Pal. II. 241 no. 4644 (1901)[3].
Dysmasia insularis Rbl.+*instratella* Rbl. Ann. KK. Hofmus. XI. 125–6, 146 no. 184 (1896)[1]: XXI. 44 no. 257 (1906)[2]: Stgr-Rbl. Cat. Lp. Pal. II. 241 no. 4644[a] (1901)[3].

Hab. Tenerife[1–3]: Santa Cruz, 8. I. 1907 (*Wlsm.*); La Laguna, 8. III. 1904 (*Eaton*), 20. V – 7. VI. 1907 (*Wlsm.*); Guimar, 30. III – 16. IV. 1907 (*Wlsm.*); Puerto Orotava, 18–30. IV. 1895 (*Hedemann*)[1], 23. IV – 14. V. 1907, ⊕ in rubbish among roots, 24. IV, excl. 31. V. 1907 (*Wlsm.*).

Mr. Eaton made the following note on his series of *Tinea immaculatella* Rbl. and his single specimen of this species:—"Out of dead *Agave* (aloes). I believe they also breed in dead *Opuntia*." I bred a single specimen, May 31st, from a larva found at Puerto Orotava, in rubbish among roots on April 24th.

78. (475·1) STATHMOPOLITIS, gn. n.

(σταθμὸς=a stable; πολίτις=a citizen.)

Type *Stathmopolitis tragocoprella* Wlsm.

Antennae slightly longer than the forewings, simple; basal joint without pecten. *Labial Palpi* porrect, median joint with dense brush beneath; terminal joint as long as the median, slender. *Maxillary Palpi*, *Haustellum*, and *Ocelli* obsolete. *Head* and face rough-haired. *Thorax* smooth. *Forewings* somewhat elongate, costa and dorsum evenly curved to apex, dorsum slightly impressed at vein 1: *neuration* 11 veins, all separate; 9 absent (coincident with 8 ?), radius subobsolete between 8 and 10, internal radial strong and acting as substitute; media strongly forked, its branches going to between 4 and 5, and 5 and 6, the latter veins somewhat approximate; 7 to costa. *Hindwings* with margins evenly curved to the blunt-pointed apex: *neuration* 8 veins; 5 and 6 stalked, rest separate; branches of media strong, to 4, and to stalk of 5+6, between which discoidal is obsolete. *Abdomen* rather long, flattened. *Legs*, hind tibiae hairy.

This genus differs noticeably from *Dysmasia* HS. in the stalking of veins 5 and 6 of the hind wings: it would appear to have some affinity to *Narycia* Stph.

156. (4644·1) STATHMOPOLITIS TRAGOCOPRELLA, sp. n.
(Plate LIII. fig. 16.)

Antennae dark fuscous. *Palpi* with the median joint dark fuscous; terminal joint pale fawn, shaded with fuscous. *Head* and *Thorax* dark fascous. *Forewings* pale fawn, mottled with dark fuscous, the patches somewhat evenly distributed over the wing, the more conspicuous of these occurring around the margins, especially a medio-dorsal patch, with one equally well-marked at the end of the cell; between the larger spots is a sprinkling of smaller ones, those around the termen and apex throwing dentate streaks through the pale fawn cilia. *Exp. al.* (♂) 12–20 (♀) mm. *Hindwings* pale greyish fuscous, with a purplish iridescence; cilia brownish grey. *Abdomen* pale greyish fuscous. *Legs* sub-olivaceous, the tarsi faintly shaded with fuscous.

Type ♂ (99094); ♀ (99095); ⊕ (99097) Mus. Wlsm.

Hab. TENERIFE: Tacaronte, 18. II. 1907 (*Wlsm.*); La Laguna, 17. III. 1904 (*Eaton*); Puerto Orotava, 23. IV – 12. V. 1907, ⊕ in dry goats' dung, 23. IV – 26. V, excl. 19. V – 18. VI. 1907 (*Wlsm.*). Thirty specimens (11 bred).

The larva, which is of a semitransparent ivory-white, with pale yellowish brown head, and with inconspicuous, much paler, pronotal plate, feeds in the old pellets of goats' dung. It is extremely abundant about the caves, on cliffs east of Puerto Orotava, and in similar situations.

Having regard to the great abundance of this insect, and to its strong superficial resemblance to *Lindera tessellatella* Blnchrd. (=*bogotatella* Wkr.), which is much more marked than in the case of *Setomorpha insectella* F., it seems extremely probable that Alpheraky had this species before him when recording "*Setomorpha bogotatella*" from Tenerife, but I have not thought it necessary to dispute Prof. Rebel's expressed opinion on the identity of the specimen which forms the subject of this bare and unsatisfactory record.

79. (465) TRICHOPHAGA Rgt.

157. (4538) TRICHOPHAGA ABRUPTELLA Wlstn.

=*bipartitella* Rgt.[7]; =**tapetzella* Rbl. (nec L.)[7].

Tinea abruptella Wlstn. Ann-Mag. NH. (3 s.). I. 120 (1858)[1]; Wkr. Cat. Lp. BM. XXX. 1003 (1864)[2]. *Tinea bipartitella* Rgt. Bull. Soc. Ent. Fr. **1892**. p. lxxxii (1892)[3]. *Tinea tapetzella* Rbl.

Ann. KK. Hofmus. VII. 268–9, 283 no. 48 (1892)[4]: IX. 17 no. 161 (1894)[5]. *Trichophaga bipartitella* Rgt. Ann. Soc. Ent. Fr. LXIII: **1894**. 121–4 (1894)[6]. *Trichophaga abruptella* Wlsm. Tr. Ent. Soc. Lond. **1894**. 537, 541 no. 16 (1894)[7]; Rbl. Ann. KK. Hofmus. XI. 123, 146 no. 177 (1896)[8]: Wlsm. Pr. Z. Soc. Lond. **1896**. 281 (1896)[9]; Stgr-Rbl. Cat. Lp. Pal. II. 236 no. 4538 (1901)[10]: Rbl. Ann. KK. Hofmus. XXI. 44 no. 248 (1906)[11].

Hab. SW. ASIA[9]—ARABIA[9]: Aden, 30. IV. 1895 (*Nurse*)[9]. AFRICA[3, 6–10]—SOMALILAND[9]: Zaila, 21. V. 1895 (*Nurse*)[9]—EGYPT[7–9]: 1887 (*Fortescue*)—TUNIS[3, 6–10]: Gabès (*Dattin*)[3–9]. **Madeiras**[1–2, 4–5, 7–10]—MADEIRA[1]: (*Wollaston*)[1–2]—PORTO SANTO: (*Wollaston*)[1–2, 7, 9]. **Canaries**[4–5, 7–11]—TENERIFE[8, 11]: Guimar, 1. IV. 1907 (*Wlsm.*); Puerto Orotava, 14–18. IV. 1895 (*Hedemann*)[8]. —GRAN CANARIA: (*Richter*)[4–5, 8–9, 11]—LOBOS: (*Alluaud*)[8–9, 11].

I took a single specimen of this species at Guimar, on April 1st.

158. (4539) TRICHOPHAGA TAPETIELLA L.

=† *tapetzella* L.

Phalaena Tinea tapetzella L. Syst. Nat. (ed. X). I. 536 no. 253 (1758)[1]; Swinh-Cotes Cat. Moths Ind. 705 no. 4804 (1889)[2]; Wlsm. Tr. Ent. Soc. Lond. **1891**. 86 (1891)[3]; Rbl. Ann. KK. Hofmus. VII. 283 no. 48 (p.) (1892)[4]. *Tinea tapetiella* Meyr. Pr. Lin. Soc. NSW. (2 s.). VII. 535 no. 78 (1893)[5]. *Trichophaga tapetiella* Meyr. HB. Br. Lp. 785–6 (1895)[6]. *Trichophaga tapetzella* Stgr-Rbl. Cat. Lp. Pal. II. 236 no. 4539 (1901)[7]; Dyar Bull. US. Nat. Mus. **52**. 573 no. 6532 (1902)[8]. *Trichophaga tapetiella* Dietz Tr. Am. Ent. Soc. XXXI. 34 (1905)[9].

Hab. EUROPE[1, 7]. ASIA[2, 4, 7]. AFRICA[3, 6]. **Canaries**—TENERIFE: Guimar, 9. III. 1907 (*Wlsm.*); Puerto Orotava, 26. IV. 1907 (*Wlsm.*). N. AMERICA[8–9]. S. AMERICA—BRAZIL: Castro, Parana, 1896 (*E. D. Jones*); Santa Catherina—CHILI: Quillota, 1887 (*Paulson*). AUSTRALIA[5]—QUEENSLAND: Toowong, 1896 (*Dodd*). NEW ZEALAND[5].

Single specimens were taken at Guimar, and at Puerto Orotava.

80. (464) MONOPIS Hb.

159. (4529) MONOPIS IMELLA Hb.

Tinea imella Hb. Smlg. Eur. Schm. VIII. Pl. **50** · 347 (1816)[1]. *Abebaea immella* Hb. Verz. Schm. 408 no. 3937 (1826)[2]. *Monopis imella* Stgr-Rbl. Cat. Lp. Pal. II. 236 no. 4529 (1901)[3].

Hab. WC. ASIA[3]. EUROPE[1–3]. **Canaries**—TENERIFE: Guimar, 13–28. III. 1907 (*Wlsm.*).

Two specimens of *imella* Hb. were taken at Guimar, on the 13th and 28th of March.

160. (4530) MONOPIS NIGRICANTELLA Mill.

Tinea nigricantella Mill. Pet. Nouv. Ent. I. 172 (1872)[1]. *Monopis nigricantella* Stgr-Rbl. Cat. Lp. Pal. II. 236 no. 4530 (1901)[2]: Rbl. Ann. KK. Hofmus. XXI. 40, 44 no. 247 (1906)[3].

Hab. S. EUROPE[1-2]—CORSICA: Ajaccio, 4–8. V. 1896 (*Wlsm.*); Corté, 9–14. VI. 1893 (*Wlsm.*)—S. FRANCE[1-2]: Cannes, V. 1890 (*Wlsm.*); Monte Carlo, 18. VI. 1898 (*Wlsm.*). N. AFRICA—ALGERIA: Biskra, 5. III – 9. IV. 1903 (*Wlsm.*); El-Kantara, 24. IV – 22. V. 1903 (*Wlsm.*)—MOROCCO: Tangier, 12. III – 18. V. 1902, 13. IV. 1901 (*Wlsm.*); Rabat, 4. IV. 1902 (*Wlsm.*). **Canaries**[3]—TENERIFE[3]: 1905 (*White*)[3]; Guimar, 6–19. III. 1907 (*Wlsm.*); Las Mercedes, 30. III. 1904 (*Eaton*); La Laguna, 8. IV. 1904 (*Eaton*).

161. (4534) MONOPIS CROCICAPITELLA Clms.

=*hyalinella* Stgr.; =*lombardica* Hrng.; =**ferruginella* Dyar (nec Hb.).

Tinea crocicapitella Clms. Pr. Ac. Nat. Sc. Phil. XI. 257, 258 (1859)[1]; Clms-Stn. Tin. N. Am. pp. viii, 49, 51 (1872)[2]. *Tinea hyalinella* Stgr. Hor. Soc. Ent. Ross. VII. 229 (1870)[3]. *Blabophanes lombardica* Hrng. Stett. Ent. Ztg. L. 295–9 (1889)[4]. *Monopis lombardica* Stgr-Rbl. Cat. Lp. Pal. II. 236 no. 4534 (1901)[5]. *Monopis hyalinella* Stgr-Rbl. Cat. Lp. Pal. II. 236 no. 4535 (1901)[6]. *Monopis ferruginella* Dyar Bull. US. Nat. Mus. **52**. 570 no. 6488 (1902)[7]. *Monopis crocicapitella* Dietz Tr. Am. Ent. Soc. XXXI. 31, 33–4 (1905)[8]; Wlsm. Fn. Hawaii. 728, 737, 754, 757, 758 no. 437 (1907)[9].

Hab. EUROPE[3-6, 9]. N. AFRICA—MOROCCO: Tangier, 8. V. 1902 (*Wlsm.*). **Canaries**[9]—TENERIFE: La Laguna, 13. I. 1907 (*Wlsm.*), 14–15. III. 1902, 18. IV. 1904 (*Eaton*), 23. V – 9. VI. 1907 (*Wlsm.*); Tacaronte, 18–19. II. 1907 (*Wlsm.*); Puerto Orotava, 23. IV – 16. V. 1907 (*Wlsm.*). UNITED STATES[1-2, 7-9]—FLORIDA: 1884 (*Morrison*). CANADA—BRITISH COLUMBIA: New Westminster, 30. V – 21. VI. 1900 (*C. W. Durrant*). HAWAIIA[9].

This species occurred at La Laguna, Tacaronte, and Puerto Orotava, from February to June.

81. (466) TINEA L.

162. (4558·1) TINEA TOECHOPHILA sp. n.
(Plate LIII. fig. 17.)

Antennae $\frac{3}{4}$; whitish, faintly annulate with fuscous. *Palpi* short, drooping, slender; greyish. *Head* and face rough; yellowish white. *Thorax* chocolate-brown. *Forewings* dark chocolate-brown, with clearly defined silvery white markings; first, a very short patch across the base, then an almost straight transverse fascia, at one-fourth, scarcely broader on the dorsum than on the costa; a short triangular spot on the middle of the costa, followed by a larger triangular costal spot, before the apex, which nearly touches the outer side of a more acutely triangular dorsal spot preceding it; at the apex is a curved, narrow, white terminal band, running through the costal and terminal cilia, leaving those of the apex as a dark rounded spot within it; tornal cilia brownish fuscous. *Exp. al.* 7–9 mm. *Hindwings* pale, shining greyish; cilia pale brownish cinereous. *Abdomen* brownish fuscous. *Legs* greyish, with pale spotted tarsi.

Type ♀ (14076); ♂ (99098) Mus. Wlsm.

Hab. TENERIFE: La Laguna, 22. II – 9. III. 1904 (*Eaton*); Forest de la Mina, 17–30. III. 1902 (*Eaton*); Las Mercedes, 30. III. 1904 (*Eaton*), 7. VI. 1907 (*Wlsm.*); Taganana, 27. V. 1907 (*Wlsm.*); Tacaronte, 31. V. 1907 (*Wlsm.*). Thirty-five specimens.

Mr. Eaton found this common on a wall, partly overgrown with lichens, at La Laguna, 22. II. 1904, and common amongst lichen-covered trees, at Las Mercedes, 30. III. 1904.

In the ♂ the forewings are usually broader, and less conspicuously marked than in the ♀, the pale spots and bands containing a few dark scales, therefore less purely white, and frequently smaller than in the ♀.

163. (4575). TINEA IMMACULATELLA Rbl.

Tinea merdella Z. ? var. *immaculatella* Rbl. Ann. KK. Hofmus. VII. 269–70, 283 no. 50 (1892)[1]. *Tinea immaculatella* Rbl. Ann. KK. Hofmus. XI. 123–4, 146 no. 180 (1896)[2]: XXI. 44 no. 249 (1906)[3]: Stgr-Rbl. Cat. Lp. Pal. II. 238 no. 4575 (1901)[4].

Hab. **Canaries**[1-4]—TENERIFE[2-3]: Santa Cruz, 23. XII – 20. II. 1907 (*Wlsm.*); La Laguna, 8. III – 6. IV. 1904 (*Eaton*); Guimar, 13–28. III. 1907 (*Wlsm.*); Puerto Orotava, 19–28. IV. 1895 (*Hedemann*)[2], 12. V – 6. VI. 1907 (*Wlsm.*)—FUERTEVENTURA[1-3]: Barranco del Rio Palma, 20. X. 1890 (*Simony*)[1].

Tinea immaculatella is by far the most abundant species in the Island; it is evidently attached to *Opuntia.* Mr. Eaton made the note: "Out of dead *Agave* (aloes). I believe they also feed on dead *Opuntia.*" The larva probably feeds on the fibrous interior of the dead, or half-dead, stems of *Euphorbia canariensis*, *Cactus*, and *Opuntia cochinelifera*: I did not however observe it.

164. (4583) TINEA FUSCIPUNCTELLA Hw.

Tinea fuscipunctella Hw. Lp. Br. 562 no. 4 (1828)[1]; Wlsm. Tr. Ent. Soc. Lond. **1881.** 242 (1881)[2]; Meyr. Pr. Lin. Soc. NSW. (2 s.). VII. 534–5 no. 76 (1893)[3]; Stgr-Rbl. Cat. Lp. Pal. II. 238 no. 4583 (1901)[4]; Dyar Bull. US. Nat. Mus. **52.** 571 no. 6503

(1902)[5]; Dietz Tr. Am. Ent. Soc. XXXI. 44, 45, 47 (1905)[6]; Rbl. Ann. KK. Hofmus. XXI. 40, 44 no. 250 (1906)[7]; Wlsm. Ent. Mo. Mag. XLIII. 267 no. 4583 (1907)[8]: Fn. Hawaii. 729, 754, 757, 758 (1907)[9]; *etc.*

Hab. EUROPE[1, 4, 8]—S. FRANCE: Monte Carlo, 2. IV. 1879 (*Wlsm.*)—S. SPAIN: Granada, 22. V – 14. VI. 1901 (*Wlsm.*). ASIA[4]. AFRICA[2, 4]—MOROCCO: Tangier, 27. II. 1902 (*Wlsm.*)—ALGERIA: Azazga, 16. IX. 1893 (*Eaton*). **Madeiras**—MADEIRA: (*Wollaston*); Funchal, 27. IV. 1904 (*Eaton*). **Canaries**[7]—TENERIFE[7]: (*White*)[7]; Guimar, 12. III – 14. IV. 1907 (*Wlsm.*); La Laguna, 26. III. 1902, 8. IV. 1904 (*Eaton*). N. AMERICA[5–6]. HAWAIIA[9]. AUSTRALIA[3]. NEW ZEALAND[3].

165. (4583·1) TINEA THECOPHORA, sp. n.

Antennae $\frac{3}{4}$; bronzy fuscous. *Maxillaries* folded. *Labial Palpi* porrect, moderately clothed, terminal joint shorter than median, the latter with a few lateral bristles; fawn-brown, paler on their inner sides. *Head* and *Thorax* dark fawn-brown, mixed with ochreous. *Forewings* ochreous, thickly sprinkled with dark fawn-brown, tending to fuscous; a small black spot in the fold at $\frac{1}{3}$ from the base, another at the end of the cell, the costa and termen having a mottled appearance through aggregation of the brownish fuscous scales; in the more or less ochreous cilia are two darker shade-lines, the one near the base interrupted at short intervals, the other near their outer ends uninterrupted, but sometimes very faint. *Exp. al.* 11–14 mm. *Hindwings* shining, yellowish grey, with a brassy sheen; cilia pale bronzy grey. *Abdomen* and *Legs* shining, pale bronzy.

Type ♂ (98331); ♀ (98336) Mus. Wlsm.

Hab. TENERIFE: ⊕ in cases on walls in houses: Santa Cruz, 25. XII – 25. I. 1907; Guimar, 28. II – 10. IV. 1907, ⊕ III, excl. 29. III – 29. V. 1907; Puerto Orotava, ⊕ IV, excl. 21. IV. 1907. Thirteen specimens.

Case dust-coloured, elongate, ovate, flattened; very distinct from that of *pellionella* L. or *allutella* Rbl. It is not bottle-shaped, nor visibly indented on any part of the margin, and is formed of grains of dust and woolly refuse, but is smooth and dense in texture, and is open at both ends, cleanly cut, evenly rounded, and without ragged edges.

Differs in the plical spot being nearer to the base than in *fuscipunctella* Hw., also in the absence of a first discal spot above it. The more general sprinkling of dark scales causes the sub-ochreous ground-colour to be less visible, and gives it a more suffused appearance. The possession of a larval case is also a very notable distinction. *Tinea fuscipunctella* may be at once distinguished by having a discal spot above and before the plical.

166. (4584) TINEA PELLIONELLA L.

Phalaena Tinea pellionella L. Syst. Nat. (ed. X.). I. 536 no. 254 (1758)[1]. *Tinea pellionella* Stn. Ann-Mag. NH. (3 s.). III. 212 no. 13 (1859)[2]; E. Wlstn. Ann-Mag. NH. (5 s.). III. 422 (1879)[3]: Lp. St. Helena 37 (1879)[3]; Swinh-Cotes Cat. Moths Ind. 703 no. 4800 (1889)[4]; Rbl. Ann. KK. Hofmus. VII. 269, 283 no. 49 (1892)[5]: IX. 17, 88 no. 162 (1894)[6]: XXI. 44 no. 251 (1906)[7]; Meyr. Pr. Lin. Soc. NSW. (2 s.). VII. 532, 535 no. 77 (1893)[8]; Wlsm. Tr. Ent. Soc. Lond. **1894**. 537, 541 no. 17 (1894)[9]; Stgr-Rbl. Cat. Lp. Pal. II. 238 no. 4584 (1901)[10]; Dyar Bull. US. Nat. Mus. **52**. 572 no. 6520 (1902)[11]; Dietz Tr. Am. Ent. Soc. XXXI. 45, 51 (1905)[12]; Wlsm. Ent. Mo. Mag. XLIII. 267 no. 4584 (1907)[13].

Hab. ASIA[4, 10]—WC.[10]—CEYLON[4]—JAPAN[10]. EUROPE[1, 10, 13]—S. SPAIN: Granada, 14. VI – 6. VII. 1901 (*Wlsm.*). N. AFRICA[5, 10]:—MOROCCO: Zig, 9. IV. 1902 (*Wlsm.*); Tangier, 14. IV – 9. V. 1902 (*Wlsm.*). **Madeiras**[2, 5, 9-10]—MADEIRA[2, 9]: (*Wollaston*)[2, 9]; Machico, 23. IV. 1904 (*Eaton*). **Canaries**[5-7, 10]—TENERIFE[5-7, 10]: IV. 1885 (*Leech*)[6]; Guimar, ⊕ on walls, 27. IV, excl. 6. V. 1907 (*Wlsm.*); Las Mercedes, 29. V. 1907 (*Wlsm.*); Garachico, 23. IX. 1889 (*Simony*)[5]. **St. Helena**: (*E. Wollaston*)[3]. N. AMERICA[10-12]. AUSTRALIA[8]. NEW ZEALAND[8].

167. (4596) TINEA LAPELLA (Hb. ?) Rbl.

[*Tinea lapella* Hb. Smlg. Schm. Eur. VIII. Pl. **37** · 252 (1796)[1]. *Acedes lapella* Hb. Verz. Schm. 401 no. 3871 (1826)[2]. *Tinea lapella* Stgr-Rbl. Cat. Lp. Pal. II. 239 no. 4596 (1901)[3]].
Tinea ? lapella Rbl. Ann. KK. Hofmus. XXI. 40, 44 no. 252 (1906)[4].

Hab. [EUROPE[1-3]. WC. ASIA[3]]. **Canaries**[4]—TENERIFE[4]: Guimar, 1906 (*W. White*)[4].

Prof. Rebel records a single worn specimen, in Mr. White's collection, from Guimar, as "*? lapella* Hb." I examined Mr. White's specimen and do not think it is *lapella* Hb., the wings seem broader, and there is no spot at the end of the cell, the colour also looks wrong; I did not myself meet with the species, and was therefore unable to compare it with European specimens.

168. (4605) TINEA SIMPLICELLA HS.

Tinea simplicella HS. SB. Schm. Eur. V. Pl. **47** · 322 (1851), p. 73 no. 54 (1854)[1]; Rbl. Ann. KK. Hofmus. IX. 18, 89 no. 163 (1894)[2]: XXI. 44 no. 253 (1906)[3]: Stgr-Rbl. Cat. Lp. Pal. II. 239 no. 4605 (1901)[4].

Hab. EUROPE[1-4]—CORSICA: Ajaccio, 6. V. 1896 (*Wlsm.*)—SPAIN: GRANADA: Granada, 19. V – 16. VI. 1901 (*Wlsm.*).

Canaries [2-4]—TENERIFE [2-4] : IV. 1885 (*Leech*)[2]; La Laguna, 23. V. 1907 (*Wlsm.*).

Two specimens taken at La Laguna on May 23rd.

82. (471) TINEOLA HS.

169. (4623) TINEOLA ALLUTELLA Rbl.

Tineola allutella Rbl. Ann. KK. Hofmus. VII. 270–1, 283 no. 51, Pl. **17** · 3 ♂ (1892)[1]: XI. 124–5, 146 no. 181 (1896)[2]: XXI. 44 no. 255 (1906)[3]; Wlsm. Tr. Ent. Soc. Lond. **1894**. 537, 542 no. 22 (1894)[4]; Stgr-Rbl. Cat. Lp. Pal. II. 240 no. 4623 (1901)[5].

Hab. **Madeiras** [2, 4-5]—MADEIRA [4] : (*Wollaston*)[4]. **Canaries** [1-5]—LA PALMA [1-3] : Los Sauces, 25. VIII. 1889 (*Simony*)[1]—TENERIFE [1] : 1889 (*Simony*)[1]; Santa Cruz, 2–20. I., 24. V. 1907 (*Wlsm.*); Guimar, 16. IV. 1907, ⊕ on walls, 27. IV, excl. 24. V. 1907 (*Wlsm.*); Puerto Orotava, ⊕ on walls, excl. 24. IV – 9. V. 1895 (*Hedemann*)[2], 24. IV – 12. V. 1907, ⊕ 23. IV, excl. 1. VI. 1907 (*Wlsm.*); Realejo, 10. V. 1907 (*Wlsm.*); La Laguna, 23. V. 1907 (*Wlsm.*).

Taken, and bred, from January to June, at Santa Cruz, Guimar, Puerto Orotava, Realejo, and La Laguna.

170. (4624) TINEOLA BISSELLIELLA Hml.

=† *biselliella* Z., Stgr-Rbl., etc.

Tinea bisselliella Hml. Essais Ent. III. 6–12, 13–14 (1823)[1]. *Tineola biselliella* Meyr. Pr. Lin. Soc. NSW. (2 s.). VII. 554 no. 116 (1893)[2]; Wlsm. Tr. Ent. Soc. Lond. **1894**. 537, 542 no. 21 (1894)[3]; Stgr-Rbl. Cat. Lp. Pal. II. 240 no. 4624 (1901)[4]; Dietz Tr. Am. Ent. Soc. XXXI. 72 (1905)[5]. *Tineola bisselliella* Dyar Bull. US. Nat. Mus. **52**. 570 no. 6487 (1902)[6].

Hab. EUROPE [1, 4]. N. AFRICA [4]. **Madeiras** [3]—MADEIRA [3]. **Canaries**—TENERIFE : Santa Cruz, 28. I – 10. II. 1907 (*Wlsm.*). N. AMERICA [5-6]. AUSTRALIA [2]. NEW ZEALAND [2].

It should be noted that Hummel named this species : " **bisselliella.** Du mot latin *bissellium*, canapé."

171. (4626) TINEOLA BIPUNCTELLA Rgt.

Tineola bipunctella Rgt. Ann. Soc. Ent. Fr. XLIII. (5 s. IV : **1874**). 579–80. Pl. **11** · 1 ♂ (1875)[1]; Rbl. Ann. KK. Hofmus. XI. 125, 146 no. 182 (1896)[2]: XXI. 44 no. 256 (1906)[3]; Stgr-Rbl. Cat. Lp. Pal. II. 240 no. 4626 (1901)[4].

Hab. EUROPE [1, 4]—SPAIN [1, 4]. N. AFRICA [4]—MOROCCO : Tangier, 4–18. XII. 1901, 5. IV – 20. V. 1902 (*Wlsm.*). **Canaries** [2-4]—TENERIFE [2-4] : Santa Cruz, 22–25. I. 1907 (*Wlsm.*); Puerto

Orotava, 13–29. IV. 1895 (*Hedemann*)[2], 3. V. 1907 (*Wlsm.*); Guimar, ⊕ on walls, 1. IV, excl. 2. VI. 1907 (*Wlsm.*).

Taken at Santa Cruz, and Puerto Orotava, and a single specimen bred from a case found on a wall at Guimar.

83. (441) LUFFIA Tutt.

172. (4435·01) Luffia rebeli, sp. n. (Plate LIII. fig. 18.)

n. syn. = **lapidella* Rbl. (nec Goeze).

Talaeporia (!) *lapidella* Rbl. Ann. KK. Hofmus. VII. 267–8, 282 no. 45 (1892)[1]: IX. 17, 88 no. 158 (1894)[2]: XXI. 42 no. 122 (1906)[3]. *Luffia lapidella* (p.) Stgr-Rbl. Cat. Lp. Pal. II. 230 no. 4435 (1901)[4].

Antennae $\frac{3}{4}$, bipectinate, pectinations commencing on joint 4, each biciliate; pale stone-grey. *Head* and *Thorax* reddish fuscous. *Forewings* shining, sericeous, pale stone-grey, rather coarsely mottled with greyish fuscous, the groups of this darker scaling somewhat more conspicuous along the margins than in the middle of the wing; the strongest of these groups are—one arising from the dorsum near the base, overspreading the fold, and diffused across the base of the cell toward the costa; another, arising from scarcely before the middle of the dorsum, crossing the fold and diffused upward across the cell, and two or three on the outer half of the costa; cilia shining, sericeous, mottled with pale greyish fuscous along their basal half. *Exp. al.* 8–12 mm. *Hindwings* pale mouse-grey; cilia slightly paler and more shining. *Abdomen* pale mouse-grey. *Legs* pale stone-grey.

Type ♂ (99066); ♀ (14094) Mus. Wlsm.

Hab. Canaries [1-4]—Tenerife [1-4]: Las Mercedes, 2100 ft., 29. II. 1904 (*Eaton*); La Laguna, 15. III. 1902, 16–25. III. 1904, ⊕ in cases on walls and rocks, 22. II – III, excl. 23. III – 10. IV. 1904 (*Eaton*); IV. 1885 (*Leech*)[2]; Puerto Orotava, 23. IV. 1907, ⊕ on rocks, 24. IV, excl. 10–20. VI. 1907 (*Wlsm.*); Pedro Gil, 1300–1500 m., 30 VII. 1889 (*Simony*)[1]. Seventeen specimens.

This is the species recorded by Rebel as "*lapidella* Goeze," but it is a much larger and more distinctly marked species. The small cylindrical cases are extremely abundant on walls, and rocks, at Santa Cruz, Guimar, Orotava, and La Laguna, but unless obtained about the time of pupation, when through want of movement they can scarcely be distinguished from the numerous empty cases of previous generations, the larvae are very difficult to rear. It is almost impossible to keep a supply of small lichens, such as they feed upon. I first received this species from the late Mr. J. H. Leech, who took it in April 1885; Mr. Eaton took several specimens, and bred three ♂ ♂ and two ♀ ♀ in 1904. There may possibly be some allied species in the Island, but I only met with *rebeli*.

IV. PSYCHINA.

I. PSYCHIDAE.

84. (733) AMICTA Heyl.

173. (4453) AMICTA CABRERAÏ Rbl.

Psyche cabreraï Rbl. Ann. KK. Hofmus. IX. 10, 46–8 no. 39 (1894)[1]: XI. 105–6, 144 no. 39. Pl. **3** · 1a–c (1896)[2]: XIII. 364, 378 no. 39 (1899)[3]: XXI. 42 no. 121 (1906)[4]. *Amicta cabreraï* Stgr-Rbl. Cat. Lp. Pal. I. 394 no. 4453 (1901)[5].

Hab. TENERIFE[1-5]: Montaña de Guerra, ⊕ *Euphorbia* (*Cabrera*)[1]; IV. 1894 (*Kraepelin*)[2]; ⊕ *Rubus idaeus*, 1898 (*Kilian*)[3]; Santa Cruz, 15. VI. 1898 (*Hintz*)[3]; La Laguna, 1600–1700 ft., ⊕ *Rubus, Cytisus*, 8. III, excl. 24. VIII. 1904 (*Eaton*); Guimar, ⊕ *Euphorbia, Rumex canariensis*, etc., 1–13. IV, excl. 25. VIII – 5. X. 1907 (*Wlsm.*).

Larva common everywhere, on various plants, *Euphorbia, Rumex*, etc., etc.; two specimens, one bred at the end of August, the other in the beginning of October.

Of the 173 species above noticed as occurring in Tenerife I have been able to observe the life-histories of 96, of which number 40 only were previously known; the larvae of 28 others having been already recorded elsewhere, 49 now remain to be discovered.

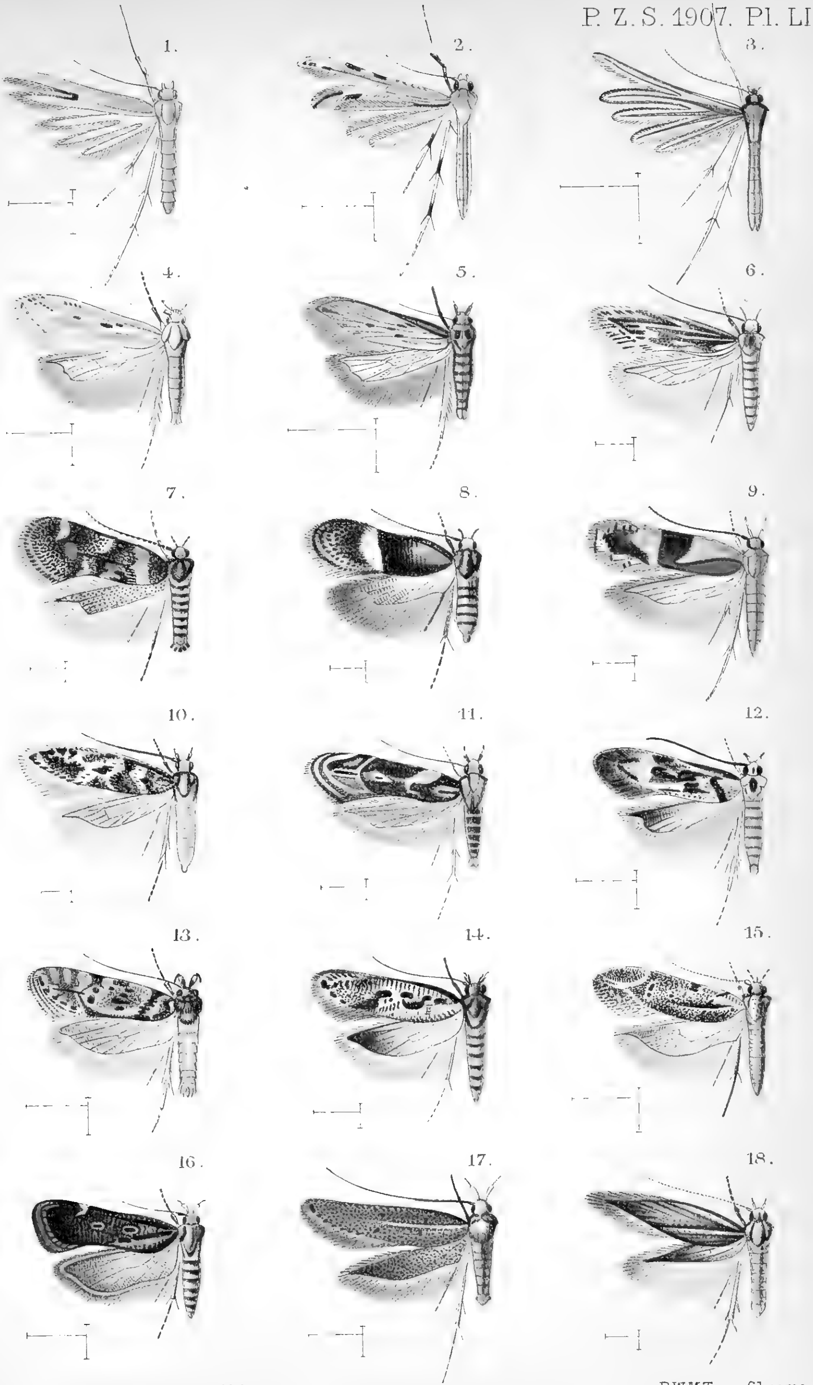
EXPLANATION OF PLATES LI., LII., & LIII.

(See Description facing the Plates.)

PLATE LI.

DESCRIPTION OF PLATE LI.

			Page
Fig. 1.	Pterophorus melanoschisma	(Type ♂ 98934) ...	920
2.	Alucita bystropogonis	(Type ♀ 98768) ...	915
3.	Alucita particiliata	(Type ♂ 98810) ...	916
4.	Metzneria dichroa..................	(Type ♂ 98304) ...	927
5.	Metzneria monochroa	(Type ♂ 98309) ...	927
6.	Apodia guimarensis	(Type ♂ 98979) ...	930
7.	Chrysopora boseae	(Type ♂ 98991) ...	931
8.	Aproaerema genistae	(Type ♀ 98993) ...	933
9.	Aproaerema thaumalea Wlsm....	(♀ *Guimar*, 98995)	934
10.	Pragmatodes fruticosella	(Type ♀ 98969) ...	929
11.	Aproaerema mercedella............	(Type ♂ 14107) ...	934
12.	Telphusa schizogynae	(Type ♂ 98997) ...	936
13.	Gelechia lunariella..................	(Type ♂ 99001) ...	939
14.	Gelechia sciurella	(Type ♀ 14290) ...	941
15.	Telphusa canariensis	(Type ♀ 98999) ...	936
16.	Trichotaphe convolvuli	(Type ♀ 99004) ...	944
17.	Chersogenes victimella	(Type ♂ 99008) ...	947
18.	Ambloma brachyptera	(Type ♂ 99007) ...	947



F.W.Frohawk del. A.J.Wendel lith.

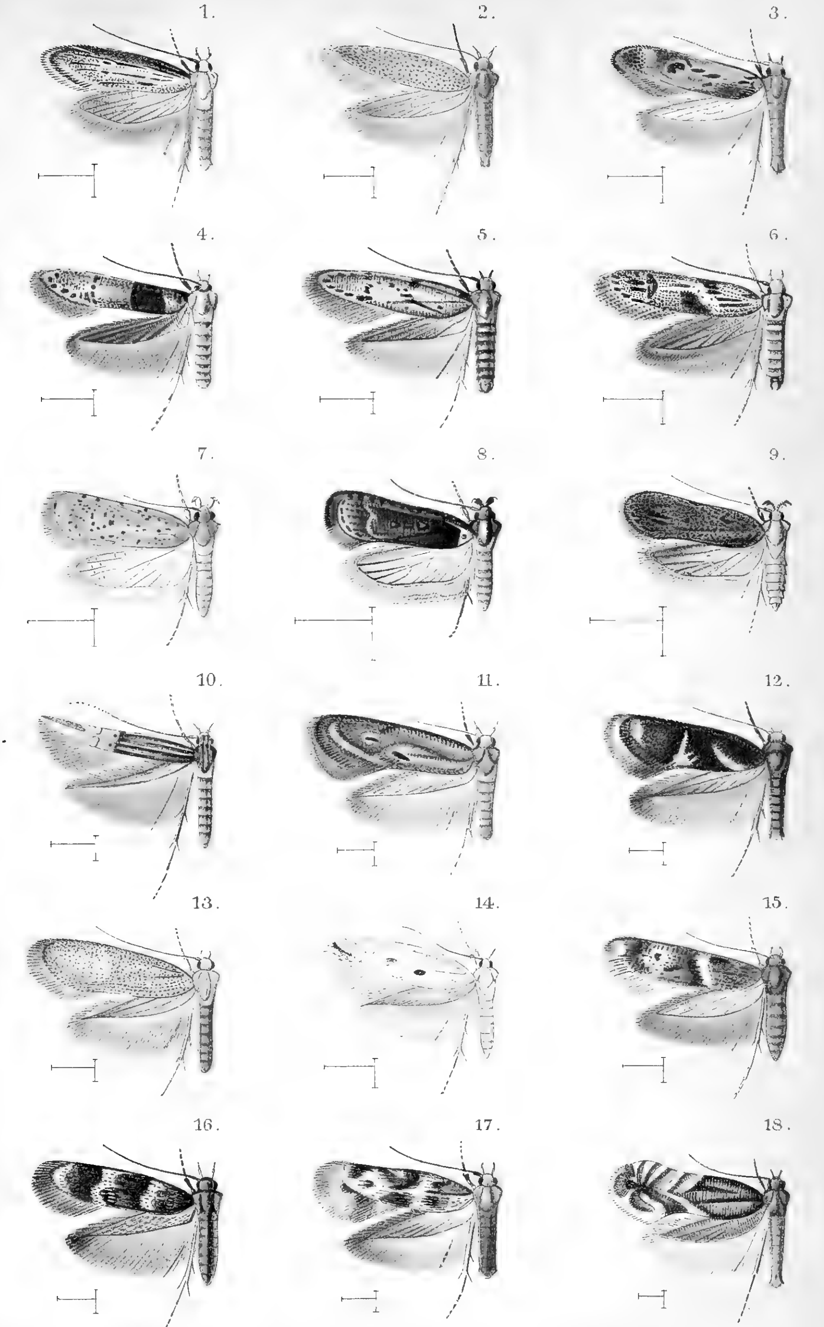
P.W.M.Trap Chromo.

TENERIFE MICROLEPIDOPTERA.

PLATE LII.

DESCRIPTION OF PLATE LII.

			Page
Fig. 1.	Symmoca canariensis *Rbl.*	(♂ 99101)	949
2.	Symmoca aegrella	(Type ♂ 99009)	949
3.	Apatema lucidum	(Type ♂ 98242)	945
4.	Blastobasis velutina	(Type ♂ 98258)	952
5.	Prosthesis exclusa	(Type ♂ 98291)	953
6.	Zenodochium polyphagum	(Type ♂ 98227)	954
7.	Agonopteryx cinerariae	(Type ♂ 99011)	955
8.	Agonopteryx perezi	(Type ♂ 99018)	957
9.	Depressaria tenerifae	(Type ♀ 99020)	958
10.	Cosmopteryx coryphaea	(Type ♂ 99029)	964
11.	Aphelosetia hypoleuca	(Type ♂ 99036)	968
12.	Perittia cedronellae	(Type ♂ 99047)	970
13.	Polymetis carlinella	(Type ♂ 99037)	969
14.	Mendesia symphytella	(Type ♀ 99045)	970
15.	Scythris fasciatella *Rgt.*	(♂ *CT.* 99087)	973
16.	Scythris arachnodes	(Type ♂ 99082)	972
17.	Scythris petrella	(Type ♂ 99085)	972
18.	Glyphipteryx fortunatella	(Type ♀ 99102)	989



F. W. Frohawk del. A. J. Wendel lith.

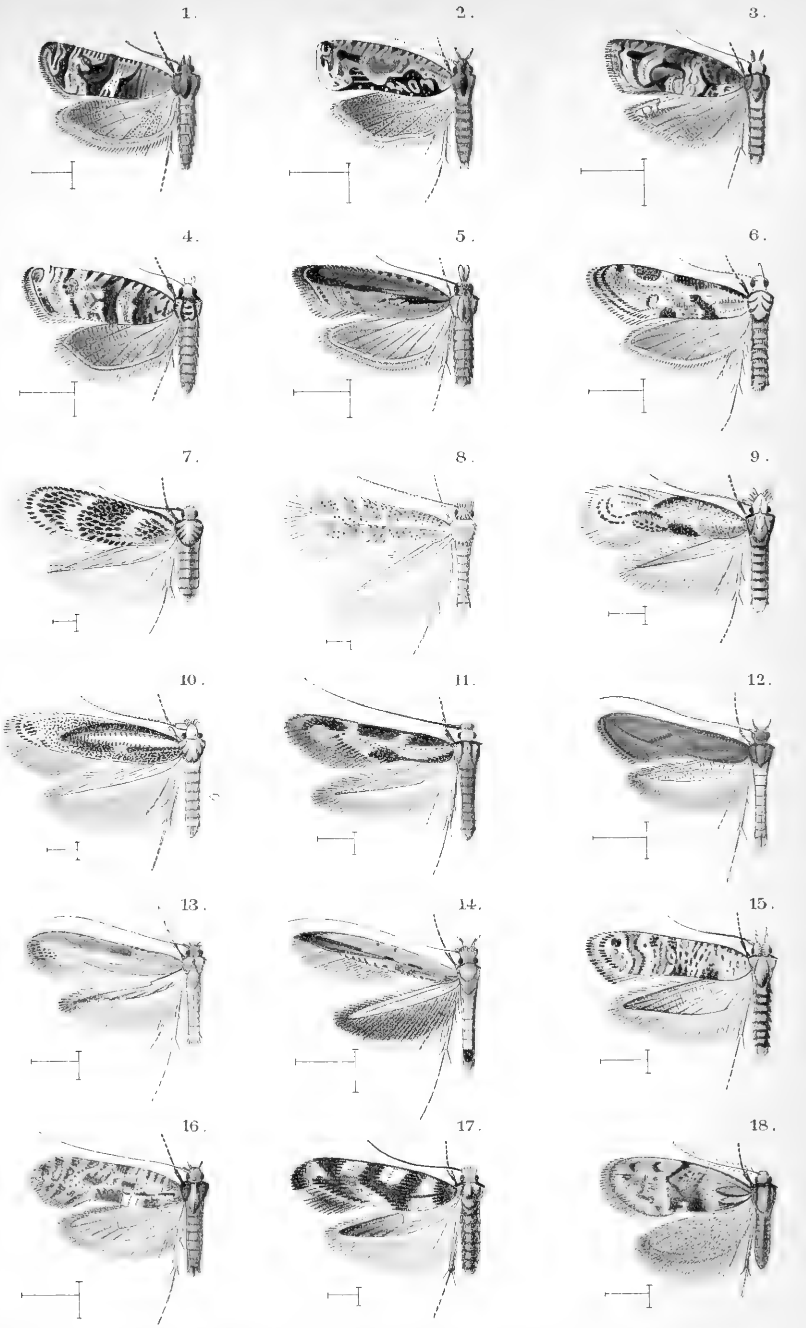
P. W. M. Trap Chromo.

TENERIFE MICROLEPIDOPTERA.

PLATE LIII.

DESCRIPTION OF PLATE LIII.

			Page
Fig. 1.	Polychrosis neptunia	(Type ♀ 99106) ...	1000
2.	Thiodia glandulosana	(Type ♀ 99112) ...	1004
3.	Acroclita sonchana	(Type ♀ 99108) ...	999
4.	Eucelis marrubiana...............	(Type ♀ 99051) ...	1007
5.	Acroclita guanchana	(Type ♂ 99115) ...	998
6.	Phalonia conversana	(Type ♂ 99104) ...	992
7.	Stigmella jubae	(Type ♀ 99119) ...	1011
8.	Phyllonorycter foliolosi	(Type ♂ 99092) ...	978
9.	Bucculatrix phagnalella	(Type ♂ 99292) ...	1013
10.	Bucculatrix canariensis	(Type ♂ 99276) ...	1012
11.	Oenophila nesiotes	(Type ♂ 99176) ...	1014
12.	Gracilaria aurantiaca *Wlstn.* ...	(♂ *CT.* 99145) ...	983
13.	Gracilaria schinella	(Type ♂ 99130) ...	982
14.	Gracilaria staintoni *Wlstn.*	(♂ *CT.* 99127) ...	982
15.	Acrolepia pappella	(Type ♀ 99151) ...	986
16.	Stathmopolitis tragocoprella ...	(Type ♂ 99094) ...	1020
17.	Tinea toechophila	(Type ♂ 99098) ...	1022
18.	Luffia rebeli	(Type ♂ 99066) ...	1027



F. W. Frohawk del. A. J. Wendel lith.

P. W. M. Trap Chromo.

TENERIFE MICROLEPIDOPTERA.

6. Dates of Publication of the Separate Parts of Gmelin's Edition (13th) of the 'Systema Naturæ' of Linnæus. By JOHN HOPKINSON, F.L.S., F.Z.S., &c.

[Received November 11, 1907.]

In this edition of the 'Systema Naturæ,' the first volume, which contains the Animal Kingdom, is in seven parts, with a titlepage dated 1788 in the first part only, the other parts not being dated. In some of these, however, there is evidence of a later date of publication, for references are given to works published more recently than 1788, but without their dates being stated. Each part really forms a volume.

The importance in questions of priority of a knowledge of the dates induced the writer to endeavour to ascertain them, and the method adopted was to search in the Catalogue of the Library of the British Museum for bibliographical works published about the end of the 18th century, in order to get contemporary evidence. Eventually a work was found which gave the desired information, and also references to journals containing notices or reviews of one or more of the parts as they successively appeared *. Nearly all of these were found to be in the Library of the Museum, and have been searched, with other contemporaneous journals, the result being that not only have the years of publication of all the parts of this edition of the 'Systema Naturæ' been ascertained, but it has been found possible in some cases to arrive at a still nearer approximation to the time of issue.

For instance, the Index, forming Part 7, published in 1792, was noticed on the 2nd of July in that year, and therefore must have appeared in the first half of the year.

In giving in a tabular form the result of this investigation, it has been thought advisable to add the dates of publication of the remaining volumes of this edition of the 'Systema' (vol. ii. being in two parts, the second part undated), although they are not zoological. The last column shows the earliest notice found; there may be earlier ones.

Some errors in contemporary records have been detected. In the 'Allgemeine deutsche Bibliotek,' 1790, the date for the second part of the first volume is given as 1788 instead of 1789, but in reviewing the third part the Editor, doubtless warned by this error, wisely refrained from giving it a date. He correctly dated subsequent parts, except the Index, for which no date is given. In the 'Efemeridi litterarie di Roma' for the 2nd of July, 1791, the first five parts were reviewed, and owing to the misleading titlepage the date for all was given as 1788.

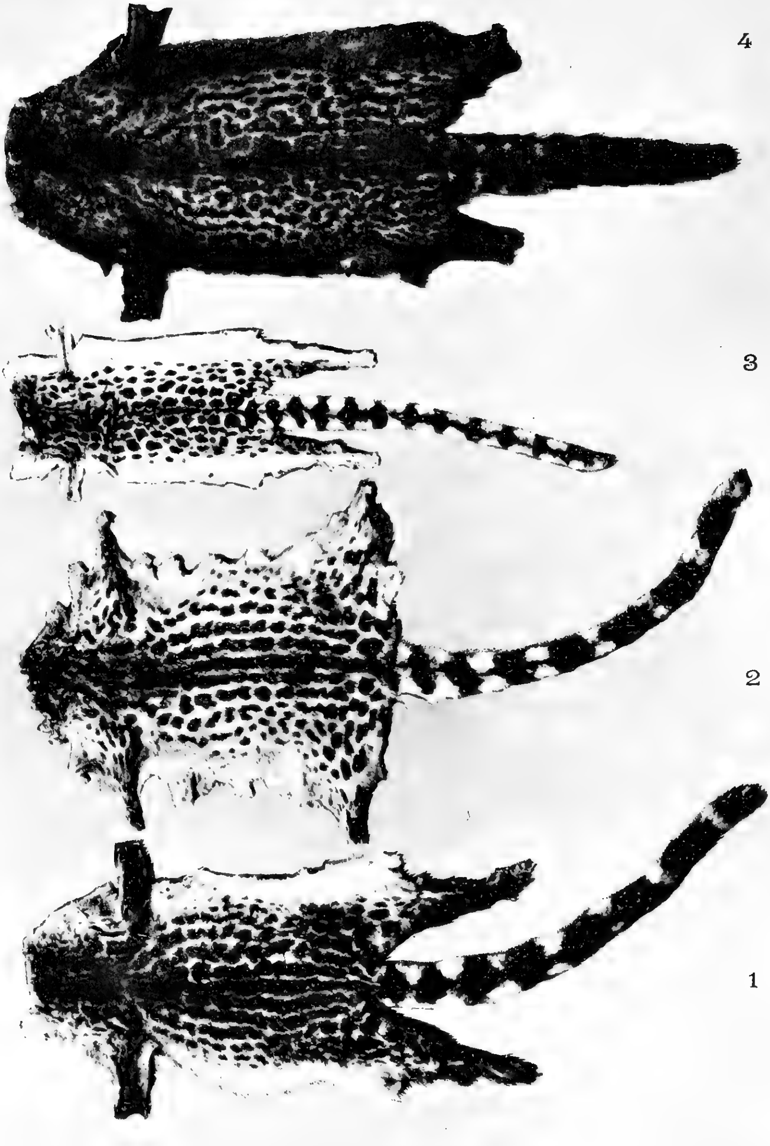
* 'Systematisches Verzeichniss,' 1785–1790 (Jena, 1795); 1791–1795 (Weimar, 1799). [Entered under Catalogues.]

CAROLI A LINNÉ. Systema Naturae per Regna tria Naturae. Ed. 13. Cura Jo. Frid. Gmelin. Tomi 3. 8vo. Lipsiae, 1788–1793.

TOMUS I.	REGNUM ANIMALIUM.	*Date of* *Publication.*	*Date of* *Earliest notice.*
Pars I.	pp. 12, 1–500. Mammalia to Aves.—Picae	1788	25. 7. 88
" II.	" 2, 501–1032. Aves.—Anseres to Passeres	1789	20. 4. 89
" III.	" 2, 1033–1516. Amphibia to Pisces	1789	20. 11. 89
" IV.	" 2, 1517–2224. Insecta.—Coleoptera to Hemiptera	1790	21. 5. 90
" V.	" 2, 2225–3020. " Lepidoptera to Aptera	1790	6. 12. 90
" VI.	" 2, 3021–3910. Vermes	1791	14. 5. 91
" VII.	" 2, 3911–4120. Index	1792	2. 7. 92
TOMUS II.	REGNUM VEGETABILE.		
Pars I.	pp. 2, i–xl, 1–884. Monandria to Polyandria	1791	4. 2. 92
" II.	" 2, 885–1662. Didynamia to Cryptogamia	1792	15. 11. 92
TOMUS III.	REGNUM LAPIDEUM.		
	pp. 1–476, tab. i–iii.	1793	25. 7. 93

The same five parts were noticed in the 'Monthly Review' for December 1792 (vol. ix.), the dates of publication being given as 1788–91, a period which covers Part 6. This notice begins: "A work so voluminous as this is now become could not be expected to start forth, like Minerva from Jupiter's brain, at once in complete form. Part after part has made its appearance in regular succession, and although we have not yet seen the whole work entire, we understand that it either is so or will be so very shortly." It was completed early in the following year.

The only recent publications in which the date of any part subsequent to the first has been correctly given are, it is believed, those of the Ray Society, the discovery having been made in 1906 during the preparation of the synonymy for the second volume of Alder and Hancock's 'British Tunicata' (1907); and these notes are now published on the suggestion of Mr. C. Davies Sherborn, who has done much valuable work in zoological bibliography and was already aware that the date on the titlepage of vol. i. of Gmelin's 'Linnæus' did not apply to the whole of the parts in that volume.



J.Green photo imp.

GENETS FROM LIBERIA.

Authorities.

Allgemeine deutsche Bibliotek, Bd. 88, ii. 193; 91, i. 208; 94, ii. 475; 99, i. 155; 101, ii. 454; 106, i. 212; 116, i. 149. Neue Allgem. deutsche Bibl., Bd. 22, i. 175. (1789–1796.)

Allgemeine Literatur-Zeitung, Jahr 1788, iii. 237; 1789, iv. 142; 1790, ii. 412; 1791, ii. 140; 1792, iv. 89, 169, 505; 1797, iii. 630.

Allgemeines Repertorium der Literatur, Jahre 1785–1790, ii. x. no. 840; 1791–1795, ii. x. no. 866 *a*. (1793, 1800.)

Bibliotek der gesammten Naturgeschichte, Bd. i. 132; ii. 310. (1789, 1790.)

Giornale dei Letterati, Tom. lxxxvi. 74. (1792.)

Göttingische Anzeigen von gelehrten Sachen, Jahre 1789, i. 641; 1789, ii. 1929; 1790, ii. 875; 1790, iii. 1953; 1791, ii. 777; 1792, i. 182; 1792, ii. 1056; 1792, iii. 1817; 1793, ii. 1169.

Neue Leipzig. gelehrte Zeitung, Jahr. 1791, ii. 583; 1793, iv. 671. (*Fide* Syst. Verz.)

Nürnberg. gelehrte Zeitungen, Jahr 1788, 589. (*Fide* Syst. Verz.)

Observations sur la Physique, Tom. xxxvii. pt. ii. p. 237 *. (Sept. 1790.)

Systematisches Verzeichniss, Phys.-nat. Lit., 1785–1790, no. 840; 1791–1795, no. 866 *a*. (1795, 1799.) [Sections of Allgem. Rep. Lit. (*supra*).]

7. Report upon a Small Collection of Mammalia brought from Liberia by Mr. Leonard Leighton. By R. I. Pocock, F.L.S., Superintendent of the Gardens.

(Plate LIV.)

[Received November 23, 1907.]

Although the collection forming the subject-matter of this paper is small and consists of flat, native-prepared headless skins, it is worthy of special notice not only because it was got together in a definite district in a part of Africa of which the fauna is not well known, but also because the skins themselves, with one or two exceptions, belong to species which are not very commonly brought to the Museums of Europe.

The skins were obtained, Mr. Leighton tells me, in a district from fifteen to twenty miles west of the Putu Mountains, which lie west of the Duobe and Cavally Rivers. The Cavally River is the eastern boundary line between Liberia and the Ivory Coast, and the Duobe is one of its tributaries joining the Cavally about seventy miles, as the crow flies, from its mouth, after running for over one hundred miles nearly parallel to the main stream.

Two of the species represented, namely *Poiana richardsoni* and *Genetta poensis*, have not been previously recorded from Liberia. Judging from the fact that there is only one skin of *G. poensis* in the British Museum and only one in Mr. Leighton's series, it would appear that this species is of somewhat rare occurrence in the area over which it is distributed. Of *Poiana richardsoni*,

* "M. Gmelin de Gottingue continue toujours son édition du Système de la Nature de Linné; il vient d'en publier la quatrième partie qui concerne les insectes."

however,—a species also reputed to be scarce—Mr. Leighton got six skins of various ages, and these prove to represent an undescribed local race of this Genet-like animal, differing in certain well-marked characters from the typical form which has been known for over sixty years. I am also compelled to regard as examples of a species as yet undifferentiated, the skins, five in number, of a second kind of Genet, which I name in honour of Sir Harry Johnston. These skins, however, belong in all probability to the species previously recorded from Liberia and misquoted as *Genetta pardina*.

Cercopithecus diana (Linn.).

Cercopithecus diana Linn., Jentink, Notes Leyden Mus. xx. p. 237, 1898; Pocock, P. Z. S. 1907, p. 682.

Mr. Leighton brought home a fine pair of Monkeys of this species and presented them to the Society's Gardens. There is also a native-prepared skin in his collection.

The figure purporting to represent this species in Sir Harry Johnston's work on Liberia (vol. ii. pl. facing p. 680) has the rusty-brown thighs typical of the species, but the long white beard characteristic of the allied form, *C. roloway*, which takes the place of *C. diana* on the Gold Coast.

Felis pardus Linn.

Subsp. leopardus, Schreb.

Felis pardus leopardus Schreb., Pocock, P. Z. S. 1907, p. 675.

Skins of the paws of a Leopard brought back by Mr. Leighton prove, if proof were wanting, that the Leopard of Liberia belongs to the typical tropical West-African forest-race, named *leopardus*, which has been previously recorded from Sierra Leone, Ashanti, and elsewhere.

Felis aurata Temm.

Subsp. celidogaster Temm.

Felis aurata celidogaster Temm., Pocock, P. Z. S. 1907, p. 660.

Two native-prepared skins, without heads and paws. These two skins completely bear out the view I expressed in the above-quoted paper as to the importance of the pattern and the valuelessness of the colour as characters for the recognition of geographical races of this species of Cat. One is of the red type and the other of the grey type; but in the red skin the sides of the body have a grey tinge, owing to the presence of the whitish-grey band in the individual hairs. So far as pattern is concerned the two skins are practically alike. The neck is longitudinally but rather confusedly barred; on the spinal area the spots are elongate or form abbreviated lines; the shoulders are somewhat thickly covered with small spots; on the sides of the body the spots are larger, often more or less confluent and sometimes rosette-like, owing to the darkening of the area between them;

on the thighs the spots are as large as on the body; the belly is white and marked with spots both larger and darker than those of the sides; the tail is dark in the median dorsal line and has indistinct lateral bars which do not encircle it.

In my recently published observations upon this species, I referred to Sir Harry Johnston's record of the occurrence of 'red' and 'grey' cats of this species side by side in Liberia; but I was unable to ascertain whether the red-haired skin he figured belonged to the strongly spotted form (*F. aurata celidogaster*) or to the weakly spotted, almost spotless form (*F. aurata aurata*). The skins brought back by Mr. Leighton demonstrate that the 'red' and 'grey' phases of the species that occur near the Cavally River belong to the strongly spotted type. Hence it may be inferred as probable that the red-haired specimen mentioned by Sir Harry Johnston also belonged to the spotted type. In that case there is no evidence of the occurrence of the weakly spotted form in Liberia; nor, so far as I am aware, has it been recorded from Ashanti, Cape Coast Castle, and Accra, whence the large-spotted form has been brought.

GENETTA POENSIS Waterh. (Plate LIV. fig. 4.)

Genetta poensis Waterhouse, P. Z. S. 1838, p. 59.

Genetta poensis Pousargues, Ann. Sci. Nat. (8) iii. p. 286, 1896 (from Mayumba, French Congo).

The type of this species is in the British Museum. Waterhouse's description of it is very accurate. It is, however, difficult to explain his comparison of the species with *Genetta pardina* Is. Geoff. St. H., and still more difficult to understand Dr. Matschie's statement that the two are very likely identical, if he read the description of *G. poensis*. As a matter of fact, it would be hard to find two more dissimilar species in the genus. *G. pardina* has a yellowish-grey ground-colour. There are only four or five rows of spots on the sides of the body, and those of at least the two uppermost rows are large, somewhat quadrangular, comparatively widely separated, with red centres and black rims, and do not coalesce into longitudinal lines. The tail is very distinctly banded with white almost to the end and only the backs of the legs appear to be dusky. In *G. poensis*, on the contrary, the spots are close-set, solid and numerous; as many as seven rows are traceable on each side and they coalesce here and there into lines, especially dorsally and on the outer side of the thighs. The limbs are almost wholly blackish brown, with at most a narrow area of paler speckled hairs down the front. The tail also is mostly black, the pale annuli being reduced to lateral patches which are much more distinct in the basal than in the distal half, which is wholly black*.

* Of the type of *G. pardina* there are two descriptions and figures extant, namely the originals published in Mag. Zool. 1832, Cl. 1, pl. 8, and those in Cuvier's and St. Hilaire's Hist. Nat. Mamm. iii. 1833, livr. lxvi. The locality was inland of Senegal. To this Matschie adds "North Cameroons and Togoland."

The skin of the Liberian example does not agree in all respects with that of the type of *G. poensis.* In the former the spots and legs are rather blacker; the ground-colour is a dark grey, faintly washed with yellow, the chest and abdomen, and especially the chest, being decidedly darker than the sides of the body, and the pale patches on the tail are greyish. In the type specimen, however, the spots are rather browner; the limbs are "brownish black"; the ground-colour is a "deep rich yellow-brown," the rings on the tail are "yellowish" or "brownish," and the belly and chest are the same colour as the interspaces of the sides of the body, that is to say yellowish brown. The labial and sub-ocular pale spots, which are usually white in Genets, are yellow. Since learning from Mr. Thomas that amongst native-prepared African skins there are usually some discoloured by fire-smoke when being dried, I am disposed to attribute the colour differences above described between the two skins to that cause. It is certain that the fur of the type of *G. poensis* has a dirty, almost gritty feeling, and its inner side is hard, as if scorched. However that may be, I do not think there can be much doubt that the two skins belong to the same *species*; whether they represent distinct geographical races or not, additional material alone can settle.

G. poensis was originally described from Fernando Po. It has not been recorded since from that island. The evidence that it came from Fernando Po appears to me to be untrustworthy, judging from the rest of the skins, alleged to be from that locality, which formed the subject-matter of Mr. Waterhouse's paper. Some of the species represented, for example *Cercopithecus martini* and *C. erythrotis*, are known to occur on the mainland of Africa; and it is, in my opinion, highly probable that the entire collection came from Lower Nigeria or thereabouts *.

As regards the allies of *G. poensis*, it appears to me to be probable that *G. angolensis* of Bocage †, recorded from Caconda in Angola, is a related form. The limbs are said to be deep black and the tail black with three or four greyish rings at the base, exactly as in the Liberian specimen of *G. poensis.* Bocage, however, describes the pattern as consisting of large quadrangular black spots and regular bands upon a cinereous ground, which seems to indicate a larger spotted form than *G. poensis.*

Nearer still to *G. poensis*, if indeed it be not specifically identical with it, as its describer suggested, is *G. genettoides* Temminck ‡, which was based upon specimens from Rio-boutry and Mina, and was said to be common on the coast of Guinea. I can find nothing in the description of the latter species to distinguish it from *G. poensis*; and the probability of their identity is enhanced by their geographical distribution §.

* See also Pousargues, Ann. Sci. Nat. (8) iii. p. 286, 1896.

† Jorn. Sci. Matt. Lisboa, ix. p. 29, 1884.

‡ Esq. Zool. Guiné, pt. 1, pp. 89–93.

§ Pousargues, on the contrary, suggested that *G. genettoides* might be a synonym of *G. pardina.*

G. servalina Puch.* from the Gaboon and *G. victoriæ* Thos.† from Entebbe, will also prove, I suspect, to belong to the same category of species as *G. poensis*. In *G. servalina*, however, the linear arrangement of the spots seen in *G. poensis* is not apparent and the tail is differently banded. *G. victoriæ* also differs in the annulation of the tail, its paler under side and other characters. *G. victoriæ* is placed by Matschie‡ in the section of species with long-haired tails. The hairs of the tail, however, are not long in the sense that those of *G. genetta*, *G. felina*, and *G. dongolana* are long.

GENETTA JOHNSTONI, sp. n. (Plate LIV. figg. 1, 2.)

This species, which is dedicated to Sir Harry Johnston, who has interested himself in the fauna of Liberia, may be briefly diagnosed as a Genet with the tail short-haired and ornamented with eight black rings, which are longer, especially distally, than the pale rings; with a black spinal stripe and with the reddish spots on the sides rather small, close-set and forming dorsally very distinct longitudinal lines separated by narrow intervening spaces; and with the limbs for the most part dark-coloured.

Hair on body short and thick, about 20 mm. long, but frequently longer on the lumbar region of the spine, where it ranges from about 20 mm. to 30 mm., forming in the latter case a sort of crest. On the tail, especially at the root, the hair is short and thick, almost woolly, and about 22 mm. in length. Ground-colour varying from a rather rich golden or ochre-yellow to a paler, almost sandy or greyish yellow, fading to a still paler yellowish or whitish-grey tint on the under side, the belly and groin being lighter than the chest and throat. From behind the shoulder to the root of the tail there extends a spinal stripe which is always black and varies in width from about 15 to 19 mm. On each side of this there are from five to six rows of spots, the three uppermost rows being well defined and the one or two inferior rows, consisting of smaller spots, more scattered, more widely spaced and showing less regular linear arrangement. The spots of the two uppermost rows coalesce wholly or mostly into definite longitudinal stripes, in which the number of spots cannot be ascertained with certainty; there appear, however, to be about twelve from behind the shoulders to the root of the tail; the spots of the third line are less coalesced than those of the two superjacent lines. The two uppermost rows are about as wide as the spinal stripe and are always wider than the intervening pale spaces, sometimes more than twice as wide. They always differ from the spinal stripe in colour, since they consist of black and red hairs intermixed, the red hairs being rather more in evidence in the centres than at

* Rev. Mag. Zool. 1855, p. 154, and Arch. Mus. x. p. 115, pl. x., 1858.
† P. Z. S. 1901, p. 87, pl. v.
‡ Verh. Internat. Zool. Congr. Berlin, 1901, p. 1138.

the edges of the spots or lines. This is also true of the spots of the third row; but the smaller spots of the inferior rows are blacker. On the upper part of the shoulders, the neck and the head, the stripes are well defined and of much the same tint as those of the body, except that the spinal stripe, where traceable, is not wholly black but tinged with red. On the sides of the shoulders and on the thighs the spots are mostly black. The fore-leg is mostly ashy brown or blackish brown, becoming darker distally, but down the front there extends a greyish-yellow stripe of varying width which appears, however, to die out at the wrist. The hind-legs, from the hocks downwards, are greyish- or brownish-black, and there is a varying quantity of hair of the same colour above the hock behind; but down the front there extends, for a shorter or longer distance, a pale stripe of varying width; this, however, is sometimes reduced to a mere remnant on the area between the hocks and toes. The tail presents eight black rings separated by seven pale rings, the last black ring being long, and the extreme tip brown above and whitish below. On the upper side of the tail the black stripes are longer than the pale stripes; but on the under side the pale stripes are longer than the black ones, or at least as long in the proximal half of the organ, although in the distal half the black ones are longer below as they also are above; the black stripes increase and the pale stripes decrease in length towards the distal end of the tail. The extent of the increase in the length of the black stripes varies, but where it is greatest, the longest is about three times the length of the shortest. Both the black and the white stripes are irregular in shape and never present straight and parallel anterior and posterior borders, and in the proximal half of the tail the black stripes become narrower and less intense laterally and inferiorly, whereas the pale stripes become broader and paler. The pale stripes are white below, but above they are yellowish with a varying quantity of blackish hairs passing from one black stripe to another and representing the median spinal stripe.

Length from fore part of nape to root of tail (on flat dried skin) about 375 mm. (=15 English inches)*; of tail about 525 mm. (=21 English inches).

This is probably the Genet of Liberia which has been identified as *Genetta pardina* Is. Geoffr. St. Hilaire† (Mag. de Zool. 1832, Cl. i. pl. 8)—a species based upon a living specimen said to have come from the interior of Senegal, but which Matschie records from the North Cameroons and the coast of Togoland. *G. pardina*, however, may be distinguished from *G. johnstoni* by having the spots on the upper part of the sides of the body large, wide, separated from each other by wide intervening pale areas and

* The complete skin would probably have measured another 125 mm. (5 English inches) giving a total of 500 mm. (20 English inches) from the tip of the nose to the root of the tail. This would make the tail approximately equal to the head and body in length.

† J. Büttikoffer, 'Reisebilder aus Liberia,' 1890; H. H. Johnston, 'Liberia,' ii. pp. 703 & 756, 1906.

ERRATUM.

p. 1043 :—

for Subsp. LIBERIENSIS, nov.
read Subsp. LEIGHTONI, nov.

not coalesced into definite longitudinal lines. The limbs of *G. pardina* also appear to be paler. They are at all events pale externally, for in the original description the toes and the inner sides are said to be blackish, and the figure represents the outer sides of both fore and hind limbs as much the same colour as the body. Matschie describes the legs as quite pale. In this, as in some other respects, his Togoland examples referred to *G. pardina* differ from the type of that species and may prove to be subspecifically distinct. I think it is highly probable, perhaps certain, that *G. johnstoni* is related more nearly to *G. pardina* than to any species of Genet hitherto described. It may indeed prove to be a subspecies of that form; but until the Genets are better known, it is difficult to decide whether a specific or subspecific value should be assigned to the various kinds that have been named.

POIANA RICHARDSONI Thomps.

Genetta richardsoni Thompson, Ann. Mag. Nat. Hist. x. p. 204, 1842.

Subsp. LIBERIENSIS, nov. (Plate LIV. fig. 3.)

Ground-colour of dorsal and lateral surfaces of the body and of the upper side of the tail a rich yellowish fawn; the fore-legs somewhat greyer externally; the hind-legs externally as far down as the hock about the same colour as the body, but greyer and paler below the hock anteriorly. The under side of the throat, chest and belly, the inside of the fore-limbs, of the hind-limbs as far as the hock, and the under side of the tail, except at the extreme tip, quite white, the white everywhere rather sharply defined from the yellow where the two tints are in contact. Underfur of the dorsal and lateral surfaces smoky grey, of the belly white, except close to the yellow, where the grey persists. On the body there is no great difference in tint between the underfur of a spot and of a yellow interspace; and this sometimes obtains on the tail, but in the majority of the skins, the underfur of an interspace on the tail is nearly white and much paler than that of an adjoining stripe. There is a median spinal stripe extending from between the shoulders, where it is narrowest, over the lumbar and sacral areas, where it is broadest, to the root of the tail. This is sometimes interrupted here and there, and sometimes doubled in parts and to a varying extent in some places strongly, in some places weakly zigzagged. The spots on the body are arranged in four or five longitudinal rows; they are all solid and usually longer than wide, the spaces between them being relatively narrow; those of the inferior rows are usually much smaller, those of the lowest row running along that part of the white under side which has grey underfur. These rows of spots extend backwards over the thighs and forwards over the shoulders and sides of the neck; on the sides of the neck the inferior rows do not form definite lines; the two upper rows, on the contrary, usually form four distinct, sometimes more or less interrupted longitudinal stripes along the nape, and these are continued forwards on to the summit of the head in the only specimen in which that region is preserved. There are a few small spots on the front of the fore-leg above the wrist and a few on the hind-leg down to the hock. The back of the hind-leg below the hock is sooty. The tail is longer than the head and body; its hair is thicker but only a little longer than that of the body. It is marked with from 12 to 13 black stripes which obviously correspond with the spots of the uppermost row on each side of the body. These stripes are not regularly annuliform, for although they encircle the tail, they are much narrower laterally and inferiorly than dorsally; they are somewhat triangular in shape, the anterior border being produced forwards in the middle line, while the posterior border is correspondingly, though to a lesser extent notched. The median spinal stripe of the body is in some places represented on the tail by a median spot or abbreviated line in the middle of the interzonal spaces; but these spaces are not subdivided by a narrow secondary ring or 'shadow-stripe' which is at least traceable in the typical form of *P. richardsoni*. In the median dorsal line, there is no very great difference in length between the stripes and the interspaces in the proximal half of the tail; but in its posterior half the stripes become sometimes much, sometimes a little narrower; the extremity of the tail for about two inches beyond the last stripe is yellowish and clouded with ashy grey, representing an indistinct double stripe above.

Measurement of type specimen:—From the fore part of the nape to the root of the tail about 275 mm. (=11 English inches); tail 400 mm. (=16 English inches).

Mr. Leighton brought back six skins of this interesting new animal, three being apparently those of adult specimens, one sub-adult and two young. The latter are darker in hue than the others, the belly being noticeably yellow. But since the fur of both, and especially of the darker of the two, appears to have been singed, I suspect that the darkness of the pelage in these young specimens is to be attributed to fire-smoke during drying (*cf. supra*, p. 1040).

Two forms of this genus have been hitherto distinguished, namely *Poiana richardsoni* Thomps. (Ann. Mag. Nat. Hist. x. p. 204, 1842), of which the British Museum has one skin, the type, ticketed Fernando Po, two ticketed Benito River (*G. L. Bates* coll.) and one ticketed Sierra Leone; and *P. richardsoni ochracea* Thos. (Ann. Mag. Nat. Hist. (7) xix. p. 372, 1907), of which the British Museum possesses the only known specimen from Yambuya, Aruwimi, River Congo (*R. B. Woosnam*).

In the typical form of *P. richardsoni* the colour is a dusky yellowish brown; the spots are variable in size but mostly large. They do not, however, run into longitudinal lines, except on the neck and shoulders. The under side of the body and inner side of the limbs are a much dirtier white than in the Liberian animal, and the pale tint is not so sharply defined from the yellowish tint of the sides of the body. The bands on the tail vary in thickness, but are almost parallel-sided all round and the intervening space is marked with a narrow ring which, although varying in distinctness, is always apparently detectable; the under side of the tail is not white and only a little paler than the upper. The example in the British Museum, alleged to have come from Sierra Leone, does not differ appreciably from the type and the two from the Benito River. Its locality is probably erroneous.

The type and only known example of *Poiana richardsoni ochracea* has the ground-colour a richer and more rusty yellow than in the others. The spots on the body are very small and widely spaced, and show signs of fusion into definite lines only upon the dorsal area between the shoulders. The caudal rings are narrow, much narrower than the interspaces, which have no intermediate stripe. The ventral surface of the body and tail and the insides of the limbs are yellowish and only a little paler than the dorsal surface.

The three subspecies may be distinguished as follows:—

a. Spots small and widely spaced; ventral surface yellowish, scarcely paler than the dorsal .... *ochracea*.

*a*¹. Spots mostly large and therefore more closely-set; ventral surface white or whitish.

- *b*. Dorsal surface a dusky yellow-brown; ventral surface yellowish or creamy white, gradually blending with the yellowish hue of the sides; under side of tail not white, hardly paler than the upper; rings on tail regular and annuliform, with intermediate rings more or less apparent .... *richardsoni*.
- *b*¹. Dorsal surface a lighter clearer yellow; ventral surface milk-white and sharply defined from the yellow hue of the sides of the body; under side of the tail white; tail-rings not regularly annuliform, somewhat triangular in shape; intermediate rings not apparent. *leightoni*.

CEPHALOPHUS DORSALIS Gray.

Cephalophus dorsalis Gray, Ann. Mag. Nat. Hist. (1) xviii. p. 165, 1846; Sclater & Thomas, Book of Antelopes, i. p. 155, 1895.

A single flat skin, apparently belonging to the typical race of this Antelope.

CEPHALOPHUS DORIÆ Ogilb.

Cephalophus doriæ Ogilby, P. Z. S. 1836, p. 121; Sclater & Thomas, Book of Antelopes, i. p. 171, pl. xx., 1895.

Two flat skins.

I find it impossible to compare the skins of this species in which the back is transversely banded with black, and shows no trace of a spinal stripe, with the skin of the previous species, *C. dorsalis*, which has a broad black spinal stripe, without concluding that the stripes of *C. doriæ* actually represent the spinal stripe of *C. dorsalis*. In other words, the forerunners of *C. doriæ* had a wide spinal stripe which in the course of the evolution of the species became broken up into transverse black bands.

December 10, 1907.

Sir Edmund G. Loder, Bt., Vice-President, in the Chair.

The Secretary read the following report on the additions made to the Society's Menagerie during the month of November 1907:—

The number of registered additions to the Society's Menagerie during the month of November was 190. Of these 73 were acquired by presentation and 7 by purchase, 104 were received on deposit, 2 by exchange, and 4 were bred in the Gardens. The total number of departures during the same period, by death and removals, was 165.

Among the additions special attention may be directed to:—

A male Hamlyn's Guenon (*Cercopithecus hamlyni*), from the Ituri Forest, new to the Collection, deposited on Nov. 5th.

Two Grisons (*Galictis vittata*), from the Argentine, presented by M. C. Livingstone Learmouth, Esq., on Nov. 21st.

A collection of Rodents, including 1 Darling's Rat (*Mus chrysophilus*), 6 Vley Rats (*Otomys irroratus*), 3 Peters' Water Rats (*Dasymys incomtus*), new to the Collection, from S. Africa, deposited on Nov. 14th.

A male Yak (*Poëphagus grunniens*), from Tibet, received in exchange on Nov. 30th.

Two Mountain Ka-Kas (*Nestor notabilis*) and 3 Kiwis (*Apteryx australis*), from New Zealand, deposited on Nov. 23rd.

One Spotted Eagle (*Aquila clanga*), captured in the North Sea, presented by Capt. R. A. Allenby, R.N., on Nov. 5th.

Mr. R. H. Burne, F.Z.S., exhibited the feet of a Common Duiker (*Cephalophus* sp.) with extensive and more or less symmetrical overgrowth of the hoofs. The overgrowth was most marked in the fore-feet, each hoof showing a tendency to an inward spiral twist. The specimen was presented to the Royal College of Surgeons' Museum by Mr. Griffin, of the Pretoria Museum, Transvaal. The Antelope was shot (wild) by a farmer, in stony bush veldt country about 40 miles from Pretoria. Nothing unusual was noticed in its gait or running powers.

Mr. F. E. Beddard, F.R.S., Prosector to the Society, exhibited a skin of the rare Marsupial *Dactylopsila palpator* (A. Milne-Edw.), which had been placed in his hands by Dr. C. G. Seligmann, F.Z.S.

A collection of Molluscan Shells, Corals, &c. collected in the Pamban Channel, Southern India, was exhibited on behalf of Mr. C. M. Venkataramanujalu.

The Secretary, Dr. P. Chalmers Mitchell, F.R.S., exhibited preparations of the intestinal tracts of the Polyprotodont Marsupials *Phascogale penicillata*, *Sminthopsis larapinta*, and *S. crassicaudata*, made from specimens kindly lent him for the purpose by Mr. H. C. Beck, F.R.S., and remarked on the simplicity of the patterns displayed by the intestinal tracts of these and other *Dasyuridæ* as contrasted with other Marsupials.

The following papers were read :—

1. On the Origin of the Mammal-like Reptiles. By R. Broom, D.Sc., C.M.Z.S., Victoria College, Stellenbosch, S. Africa.

[Received August 1, 1907.]

(Text-figures 244–247.)

A considerable amount of discussion has recently been given to the question of the origin of Mammals, and so far from a general agreement having been arrived at, men of science are becoming more definitely arranged into two groups—those who believe that mammals are descended from Amphibia and those who hold that they sprang from Reptiles; and to judge by the reports of a recent Congress, the opposing opinions seem to be held with a warmth reminiscent of a bygone age. At the meeting of the British Association in South Africa in 1905 I read a paper (**1**) endeavouring to show that the case for descent of the mammal from a Cynodont reptile, or a closely allied form was very strong, and that the main objection urged against it from the mode of development of Meckel's cartilage in the mammal is of no weight, the condition of affairs being exactly what we should expect from our knowledge of the Cynodonts. In the present paper I wish to say little on the origin of mammals, as the British Association paper has recently been published, and there is little to add to it that is new; but I desire to call attention to some new discoveries that throw most important light on the origin of the mammal-like reptiles. The Anomodonts, the Cynodonts, and the Therocephalians are fairly well known; some of them even as well known as regards their osteology as living reptiles, but concerning their origin or nearest reptilian allies we have hitherto known little or nothing.

Though Owen (2), as far back as 1845, recognised mammal-like features in the Anomodont dentition, and also later when he described the skulls of Cynodonts and Therocephalians, Cope (3) seems to have been the first to have expressed the view that the mammalian resemblances found in certain Permian reptiles were due to a genetic affinity. Between 1875 and 1878 the first remains of Pelycosaurian reptiles were discovered, and Cope recognised in them so many mammalian characters that he suggested that the Mammalia had probably been descended from them. As the South African Anomodonts had also a number of similar mammal-like characters, he united the two suborders in a new order Theromorpha, a name afterwards changed to Theromora. As the result of later work on the Pelycosaurians by Baur and Case (4), and on the South African forms by Seeley and myself, it became manifest that the group Theromorpha is not a natural one, the Pelycosaurs being more nearly related to the Rhynchocephalians than to the mammals. Osborn (5) in 1903, in his most important paper on the classification of the reptiles, reviewed the recent work and came to the conclusion that the reptiles had very early become specialised along two very distinct lines—the one giving rise to the lizard-like forms and the other to the mammal-like. The former group he called the Diapsida and the latter the Synapsida. In the Diapsida he placed all the primitive Rhynchocephaloid groups, including the Pelycosauria, as well as most of those reptilian orders which seem to have sprung from a *Sphenodon*-like ancestor. In the Synapsida he placed, besides the Anomodonts and "Theriodonts," the Chelonians and Plesiosaurians. Though most recent opinion has been in favour of some such division of the Reptilia, it seems doubtful if the Chelonia and Plesiosauria should be placed in the Synapsida, and I am inclined to agree with Boulenger (6) in placing them rather with the Rhynchocephaloid groups. It seems to me, however, advisable to retain Osborn's names for the two large groups, but making the Synapsida only include the mammal-like forms, with possibly the Pareiasauria.

Within the last few years our knowledge of the Synapsida has greatly increased. Four well-marked suborders of mammal-like reptiles are recognised, viz.: the *Anomodontia* (Owen), for the Dicynodon-like forms; the *Cynodontia* (Owen), for the reptiles like *Galesaurus* and *Gomphognathus* with a well-developed secondary palate; the *Therocephalia* (Broom), for the mammal-like reptiles, such as *Scylacosaurus*, which have a Rhynchocephalian palate; and the *Dinocephalia* (Seeley), for those specialised forms which resemble *Titanosuchus*. For these four suborders the term *Therapsida* has been proposed (7) as an embracing order. *Pareiasaurus* and its allies, such as *Tapinocephalus*, *Propappus*, &c., may perhaps be considered to form a second order of the Synapsida, the *Pareiasauria* Seeley.

The early orders of the Diapsida are less fully known than those of the Synapsida. The Pelycosauria are, thanks to the labours of Cope, Baur, and Case, now fairly well known, though there are still a number of serious blanks in our knowledge. The digital formula is not certainly known and more definite knowledge is required of the structure of the tarsus. Even in the skull there is still a little doubt about the structure of the posterior temporal region. Most authorities, however, seem agreed in placing the order in the Diapsida.

The Procolophonia are much better known, nearly every detail in the osteology of *Procolophon* being as fully known as in recent animals. In most of its characters the latter comes nearer to the early Rhynchocephalians than to the mammal-like forms. The digital formula is that of the lizards—2, 3, 4, 5, 3 ; there are well-marked abdominal ribs, the vertebræ are notochordal, the prevomers carry teeth, there is a quadrato-jugal bone, and the very small coronoid process is formed by a distinct coronoid bone and not by the dentary. It shows affinities, however, with the mammal-like groups in having a well-developed precoracoid, but this is a character which must have been possessed by early Diaptosaurians, as it is met with in the Pelycosaurians, in *Mesosaurus* and in *Heleosaurus*. Most of the other important characters are common to the early Diapsidan and early mammal-like forms—*e. g.*, the plate-like pelvis, the intercentra, the pro-atlas, and the columella cranii. From the consideration of these points I have expressed the opinion that *Procolophon* should be placed among the early members of the Diapsida rather than among the Synapsida.

While the Pelycosauria and the Procolophonia seem to be Diapsidan orders, it must nevertheless be admitted that both show certain resemblances to the mammal-like groups. As already mentioned, Cope believed the Pelycosaurs to be closely allied to the South African "Theriodonts," and *Procolophon* has been placed among the mammal-like forms by Seeley (**8**), Boulenger (**6**), and others. The most striking resemblance is in the shoulder-girdle with its well-developed precoracoid. As, however, an ossified precoracoid is found in the "Cotylosauria" and even occasionally among the Stegocephalia, we should naturally expect it to be met with in the early forms of both Synapsidan and Diapsidan reptiles. The digital formula of the Therocephalians and other Therapsida, viz. 2, 3, 3, 3, 3, marks them off fairly distinctly from the Diapsidans with a typical formula of 2, 3, 4, 5, 3. Still, when dealing with Permian reptiles, we find the Diapsidan and Synapsidan types approach each other so markedly that we are constantly in doubt about the position of individual forms. No distinction can be found in the shoulder-girdle, the palates are similar and both have plate-like pelves ; and it becomes manifest that the two groups have had a common ancestor, or that one of the groups has sprung from a member of the other.

I have been inclined to find the common ancestor in the somewhat artificial group "Cotylosauria," a view also supported by Osborn (**5**) and Broili (**9**), while Boulenger (**6**) is inclined to place the common ancestor among the Stegocephalia. Part of our difficulty consists in our not knowing very clearly what a Cotylosaurian is. The term was proposed by Cope for reptiles resembling *Diadectes* and *Empedias*, and many other forms were afterwards included, for the most part very imperfectly known, but supposed to agree with *Diadectes* in having the temporal region roofed. Case has recently shown that in some members of the Diadectidæ there is a small temporal fossa, while in the structure of the palate and some other points they differ greatly from other known forms, such as *Pariotichus*, and he proposes to remove them from the Cotylosauria altogether and place them in another order Chelydosauria. Broili's (**9**) recent work on *Labidosaurus* shows that we have here a fairly highly organised type approaching in many points the Procolophonia. Then there is *Pareiasaurus*, which is often also placed in the Cotylosauria, and which agrees with most of the genera in having the temporal region roofed, but differs markedly in a number of other points. Whether it is possible to keep the Cotylosauria as a superorder embracing a number of suborders which differ greatly can only be satisfactorily answered when more is known of the American types. In the meantime it seems better even to multiply the already large number of reptilian orders or suborders than to group together in an artificial manner forms that have little affinity.

As possible ancestors of the Synapsida and Diapsida we may dismiss the Diadectidæ as too specialised. The Pareiasauria, while they might be considered as ancestral to the mammal-like forms, are much too specialised to have been the ancestors of the Diaptosaurians, even though they still seem to retain the digital formula 2, 3, 4, 5, 3 *. The Pariotichidæ, on the other hand, have most of the characters we should want in the common ancestor of the later reptiles. The few known specimens, however, have lost the cleithrum which the ancestor must have had, as it is still found in the Anomodonts. *Pareiasaurus* and the Diadectids have it well developed, and it is not unlikely that forms may yet be discovered resembling *Pariotichus* and *Labidosaurus*, but retaining the cleithrum. Such a form might well be the looked-for ancestor.

Until recently the gap between the Therocephalians and the Cotylosaurs has been a fairly wide one, but a specimen has just been discovered which largely bridges it over. This is a small animal found at Victoria West. It is so well preserved that, with the exception of the temporal region, the palate and the tarsus, almost every detail of the anatomy is known. It has been named

* There has been some difference of opinion on the digital formula of *Pareiasaurus*, Boulenger definitely stating that it is 2, 3, 3, 3, 3. I have elsewhere shown (**10**) that in the very closely allied Pareiasaurian genus *Propappus* there is reason to believe that the formula is 2, 3, 4, 5, 3.

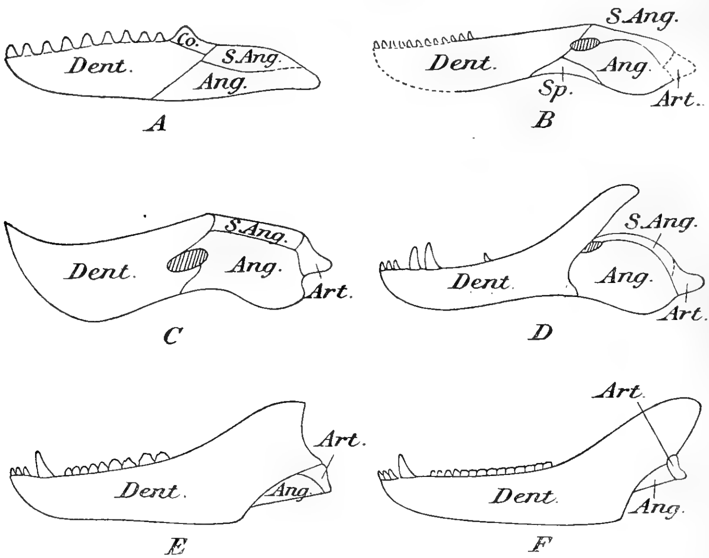
Galechirus scholtzi (**11**). The facial region is not unlike that of *Palæohatteria*, there being no specialised canine. The lower jaw in general structure is essentially similar to that of the Anomodonts and differs from that of the Therocephalians in the absence of the large coronoid process of the dentary. The shoulder-girdle is like that of the Therocephalians and differs from that of the Anomodonts in the absence of the cleithrum. The humerus, ulna, and radius are like those of the Therocephalians, except that the ulna has no olecranon process. The carpus is very like that of the Anomodonts, and the digital formula is 2, 3, 3, 3, 3. There are intercentra in the cervical region and the ribs are single-headed. There are large numbers of slender abdominal ribs. The pelvis is plate-like, with the ilium small and passing upwards.

It will be seen that we have here a form which agrees with the mammal-like reptiles in the digital formula, in the structure of the shoulder-girdle, and for the most part in the limbs, but with a somewhat more primitive mandible, but which differs from them and agrees with the Diapsidan reptiles in having abdominal ribs and a plate-like pelvis. Had the manus not been preserved, I should have placed the form somewhere near the Pelycosauria, and the Procolophonia among the primitive Diaptosaurians; and had the mandible not been so essentially Anomodont, I should still have done so in spite of the digital formula. But the combination of characters shows that we have a form on the mammalian line, but not far removed from the Diaptosaurian or Cotylosaurian origin. Exactly where the point of origin has been is not clearly indicated, but the descent has most probably been either from a generalised Cotylosaurian or from a primitive Diaptosaurian. How the formula 2, 3, 4, 5, 3 was changed into 2, 3, 3, 3, 3 is not known, but in *Galechirus* we see some indication of the change. The metacarpals increase in size from the first to the fourth, just as is usually the case in Diapsidans, and this seems to show that the limbs were directed outwards from the body considerably, as in lizards, and that the reduction had but recently taken place. In the Therocephalian *Theriodesmus* (**12**) there seems from the figures to be some indication of a transition from the Diapsidan to the Synapsidan formula, but in an undoubted Therocephalian pes I have examined there is not the slightest indication of the larger formula, the numbers being the typical 2, 3, 3, 3, 3, and I feel inclined to believe that the change has taken place in two rapid stages, 2, 3, 3, 4, 3 and then 2, 3, 3, 3, 3.

In the accompanying figures the development of a number of important structures is traced through the various groups that lie between the Cotylosaurs and the Mammals. The types in no case lie in the direct line of descent and are only taken as the best-known examples of the different stages of the development.

I shall not take into consideration the skull generally, as though it is well known in all the Therapsidan suborders it is very imperfectly known in the Cotylosaurians, and even in the Pelycosaurs there are one or two points in doubt, and in *Galechirus* both the palate and temporal region are unknown.

Text-fig. 244.



Mandibles of Mammal-like Reptiles.

A. *Procolophon trigoniceps.*
B. *Galechirus scholtzi.*
C. *Dicynodon jouberti.*
D. *Lycosuchus vanderrieti.*
E. *Cynognathus platyceps.*
F. *Gomphognathus kannemeyeri.*

Ang., angulare; *Art.*, articulare; *Co.*, coronoid; *Dent.*, dentary; *S.Ang.*, sur-angulare; *Sp.*, splenial.

The mandible is, however, well known in most types. In *Procolophon* the anterior half of the jaw is formed of two boxes, the dentary forming the outside and supporting the teeth and a large splenial, which forms the greater part of the inside. Immediately behind the row of teeth is a well-developed little coronoid bone. On the inner side, at the back of this bone and near the top of the jaw, is a large oval opening into the large cavity of the posterior part of the mandibles. On the outer side of the jaw just behind the dentary is seen the large angular and surangular, each forming about half of the outer surface of the posterior half of the jaw. The angular appears to pass back to the angle of the jaw and to form the whole of the inner side of the posterior part, the surangular forming the upper border. The articular is small and wedged in between these two bones. In *Pareiasaurus* there is certainly a large angular and a large splenial a little like that in *Procolophon*, but the posterior part of the jaw is not well known. In *Dimetrodon* the jaw bears considerable resemblance to that of *Procolophon*. There is a large splenial on the inner side and a large angular on both the inner and outer sides of the posterior part. There is also a large surangular and a small articular. There is some evidence of a coronoid element. In front of the articular on the inner side a distinct element called the prearticular is said to occur.

In *Galechirus* only the outer side of the jaw is known, and it differs from that of the early Diaptosaurian types mainly in the absence of a distinct coronoid bone. The angular forms more of the outer surface and probably less of the inner.

In the Anomodont such as *Oudenodon* (**13**), the jaw is fairly similar to that of *Galechirus* except that there are no teeth. On the outer side the angular is a large bone somewhat oval in shape which forms the greater part of the posterior half of the jaw. The surangular lies above it, but is for the most part hidden by it. There is no coronoid bone. The splenial is well developed. The articular is only in part hidden by the angular.

The mandible of the Therocephalians is pretty fully known, almost all details being known in both *Lycosuchus* (**13**) and *Hyænasuchus* (**14**). The only important difference between this type of jaw and that of the Anomodont is that the dentary has its upper and posterior end developed into a large coronoid process.

In the Cynodonts the mandible differs greatly from that of the Therocephalians, owing to the dentary becoming greatly developed and the other elements greatly reduced. The dentary forms not only a large coronoid process but nearly the whole of the back part of the jaw, and hides the whole of the surangular and much of the angular and articular.

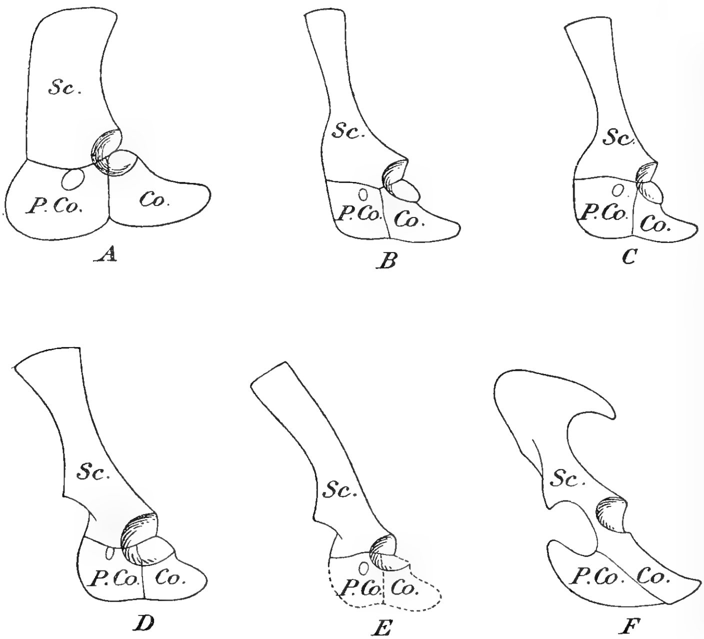
In the mammal the dentary forms the whole jaw, the rudimentary elements having disappeared.

The next important structure whose evolution may be considered is the shoulder-girdle. Fortunately this is well known in most groups.

In the Labyrinthodonts the girdle is made up of a large flat interclavicle, with two large flattened clavicles and a pair of slender cleithra—these membrane-bone elements supporting the cartilage-girdle proper, which no doubt was made up of a permanently cartilaginous precoracoid and coracoid with an ossified scapula. Of course in most specimens of the girdle proper only the scapula remains as a fossil. In some forms, e. g. *Eryops*, the whole girdle is ossified and we find well-developed coracoids and precoracoids.

In most of the Cotylosaurs the same eleven elements are met with. In the Diadectidæ there is a large precoracoid and coracoid, with a large scapula which is supported in front by a well-developed cleithrum. In *Pareiasaurus* there is also a well-developed cleithrum, and the shoulder-girdle for the first time has a distinct acromion formed by a twisting of the anterior scapular border. In *Pariotichus*, according to Case, there is no cleithrum, and in none of the members of the Diapsidan phylum does the cleithrum ever reappear. The Pelycosaurs, *Procolophon* and its allies and *Mesosaurus*, all retain the ossified precoracoid, but soon this too becomes lost as a bone and is never again found in any of the Diapsida. Anterior developments of the scapula sometimes take the place of the lost precoracoid, as in the Chelonia, the Plesiosaurs, and in the Ostrich; and the coracoid and scapula occasionally have anterior developments which are somewhat

Text-fig. 245.



Shoulder-girdles of Mammal-like Reptiles and of *Ornithorhynchus*.

A. *Procolophon trigoniceps*.
B. *Galechirus scholtzi*.
C. *Ictidosuchus primævus*.
D. *Oudenodon baini*.
E. *Galesuchus browni*.
F. *Ornithorhynchus anatinus*.

Sc., scapula; *Co.*, coracoid; *P.Co.*, precoracoid.

precoracoid-like as in the Lizards, but a distinct precoracoid never appears when once lost. In *Procolophon* the scapula is short and broad, the precoracoid of large size with a round foramen, and the coracoid also well developed. These three elements are never anchylosed even in old specimens. The clavicle passes up along the front of the scapula, taking the place of the lost cleithrum. The interclavicle is large and T-shaped. In *Mesosaurus* and *Heleosaurus* (**11**) the scapula, coracoid, and precoracoid are completely anchylosed.

In *Galechirus* the scapula is long and narrow, except at the lower end, where it broadens out for articulation with the precoracoid and coracoid. There is no distinct acromion, though the anterior border of the scapula is somewhat twisted. The coracoid and precoracoid are well developed, but much smaller than in *Procolophon* and not anchylosed. The interclavicle has a large and rather broad posterior portion. The clavicles are well developed and appear to pass a considerable distance up the front of the scapula, but there does not appear to be a cleithrum.

In the Therocephalia the shoulder-girdle is not very fully known. In *Ictidosuchus* (**15**) only the cartilage-bone elements are preserved. The scapula is long and slender in its upper part and broad at the lower end. There is no distinct acromion and no twisting of the anterior border of the bone. The precoracoid is a large flat, somewhat square-shaped bone with the foramen completely surrounded by the bone. The coracoid is smaller and of the usual shape. It is not known whether there is a cleithrum or not.

In the Anomodonts the shoulder-girdle is well known. The scapula is long and well developed and has a well-marked acromion. The precoracoid has a large foramen, which is in part formed by the scapula. One of the most noteworthy characters in this type is the presence, at least in *Dicynodon* and *Oudenodon*, of a distinct cleithrum. The interclavicle in some forms is short, e. g. *Lystrosaurus* (**16**), while in others, e. g. *Dicynodon*, it is elongated.

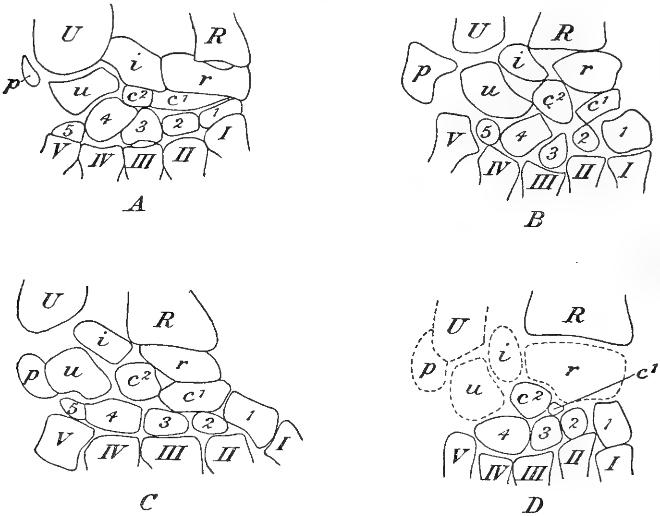
In the Cynodontia the shoulder-girdle is not fully known. Seeley (**17**) has figured the scapula with portions of the coracoid and precoracoid of *Cynognathus*, and I have recently figured an imperfect shoulder-girdle of *Ælurosuchus* (**18**). The scapula is well developed and somewhat like that of the Anomodonts, having a well-formed acromion. The coracoid and precoracoid, so far as known, are also Anomodont-like. There is no evidence of a cleithrum. There is a well-formed clavicle in *Diademodon*, but the interclavicle is not yet known in any Cynodont, but probably occurs in all species.

In the closely allied Monotremes the only essential difference in the shoulder-girdle from the Cynodonts is in the precoracoid, which has become reduced and no longer articulates with the scapula.

In Marsupials and Eutheria the precoracoid is lost as a skeletal element and the coracoid rudimentary, but, as I discovered some years ago (**19**), the Marsupial at birth still has a large coracoid which articulates with the sternum as in the Monotremes.

The examination of the humerus, radius, and ulna in the various groups does not throw much light on their affinities, but from the study of the carpus some interesting facts are obtained.

Text-fig. 246.



Carpus of *Sphenodon* and of Mammal-like Reptiles.

A. *Sphenodon punctatus* (after Howes and Swinnerton).
B. *Galechirus scholtzi*.
C. *Oudenodon trigoniceps*.
D. *Galesuchus browni*.

c^1, c^2, centralia; *i*, intermedium; *p*, pisiform; *R*, radius; *r*, radiale; *U*, ulna; *u*, ulnare; 1, 2, 3, 4, 5, carpalia; I, II, III, IV, V, metacarpals.

In the case of the fossil carpi the elements are figured exactly as found. In *Galechirus* and *Oudenodon* there is evidently a slight lateral displacement.

The carpus is practically unknown in any Cotylosaurian. Case has endeavoured to restore that of *Pariotichus* (**20**), but too many points are left in doubt to make it advisable to take it at present into consideration. Fortunately the carpus is well known in the two very primitive Diapsidan genera *Dimetrodon* (**21**) and *Procolophon* (**22**), as well as in the pre-Cotylosaurian genus *Eryops*. In all three genera the carpus is so essentially similar, and so like that of *Sphenodon*, that we may feel pretty sure the Cotylosaurian carpus was also of the *Sphenodon*-type.

In *Dimetrodon*, as shown by Case (**21**), there is a large radiale and ulnare, with a smaller intermedium between two well-developed centralia, of which the inner is the larger, and a fair-sized pisiform. In the distal row are five carpalia, of which the second is the largest.

In *Procolophon* (**22**), as I showed some time ago, the carpus has the usual four elements in the proximal row, two centralia, of which the outer is the larger, and four distal carpals. It differs from that of *Dimetrodon* and agrees with that of *Sphenodon* and most reptiles in having the pisiform articulating with the ulna. There is also evidence of specialisation in the 5th carpale being lost, though retained even in *Sphenodon*.

In the recently discovered *Galechirus* the carpus is preserved in perfect condition. In the proximal row are a large radiale and ulnare, with a smaller but well-developed intermedium and pisiform. In the distal row are five carpalia, but the 5th is small. In the centre of the carpus are two centralia, of which that to the radial side is the smaller and lies between the radiale and the 1st carpale. It will be seen that this small animal with a mammalian digital formula has nevertheless a carpus almost exactly similar to that in *Sphenodon*.

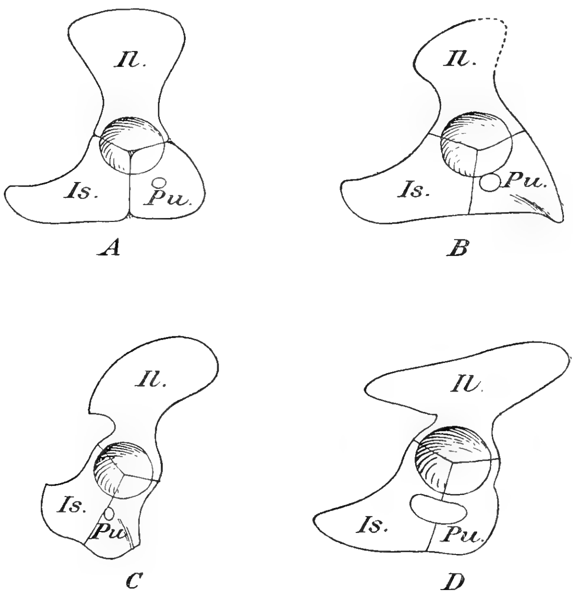
The only Therocephalian carpus at present known is that of *Theriodesmus* (**12**), which, though well preserved, has unfortunately the elements somewhat displaced. Restorations have been attempted by Seeley, Bardeleben, and myself. We may feel pretty certain that there are the usual four bones in the proximal row, and also that there are only four in the distal row. There are apparently two centralia, one of which is rudimentary.

In the Anomodontia the carpus is much better known, that of both *Oudenodon* and *Opisthoctenodon* (**23**) being represented by perfect specimens. In *Oudenodon* the arrangement is almost precisely similar to that in *Galechirus*, there being two large centralia, of which the inner lies between the radiale and the 1st carpale. There is a small but distinct 5th carpale. In *Opisthoctenodon* there is no 5th carpale and the inner centrale is not so markedly between the radiale and 1st carpale.

Until recently very little has been known of the Cynodont carpus. A very imperfect carpus of *Microgomphodon* (**24**) has been figured by Seeley, but it is too badly preserved to help us much. About six months ago I figured the carpus of a new Cynodont *Ælurosuchus* (**18**), which shows at least the distal carpals and the centralia in true position, and though the proximal elements are somewhat displaced, we may feel fairly sure of their relations. There are but four distal carpals, the 5th being lost as in Mammals. Of the centralia that to the radial side is rudimentary, the other being large, from which we may infer that the centrale of the mammalian carpus corresponds to the outer of the two centralia of the primitive reptilian carpus. In the proximal row there are probably the usual four bones. We thus find that the Cynodont carpus is identical with that of the typical Mammal, except that whereas in the latter there is only a C^2, the former has, in addition to a C^2, a rudimentary C^1.

The evolution of the pelvis is now pretty well known. Perhaps the most primitive type of pelvis in any land animal is that seen in some of the Stegocephalia, such as *Discosaurus*. Here we have an ilium with a fairly well-marked crest directed mainly backwards, an ischium of the flat semicircular type, and a rounded pubis. It is from some such type as this that all the later pelvic types have sprung. In the early Diapsidan reptiles the pelvis is but little modified from the early type. In *Procolophon* the pubis and ischium are flat and lie in one plane, forming the typical plate-like pelvis. The ilium has a fairly broad crest. In *Palæohatteria* the pelvis is almost exactly similar, and in a large number of the later Diapsidan orders the same type is retained with little modification. In the Pelycosauria, as exemplified by *Embolophorus* (**25**), the pelvis is of the plate-like type, but the ilium differs from the earlier forms in having the crest directed very markedly backwards.

Text-fig. 247.



Pelvis of Mammal-like Reptiles.

A. *Procolophon trigoniceps.*
B. *Galechirus scholtzi.*
C. *Oudenodon trigoniceps.*
D. *Diademodon mastacus.*

Il., ilium; *Is.*, ischium; *Pu.*, pubis.

Among the Colytosaurs, and even above the Labyrinthodonts, the ilium presents a number of modifications in connection with the various habits of the animals. In *Eryops* the ilium is long and slender and passes straight up. In *Labidosaurus* (9) the ilium is relatively small and is directed somewhat backwards. In *Pareiasaurus* (26) the pelvis has a large ischium and a smaller pubis, and though much specialised, they can still be referred to the plate-like type. The ilium, however, is quite unlike that of any of the early types and resembles that of the Anomodonts and Mammals in having a large crest which is directed markedly forwards.

In passing to the Therapsida the earliest type known is that found in *Galechirus*. Here the ilium is directed upwards and the crest is short. The pubis and ischium are of the plate-like type. The pubis is nearly square, with the anterior and outer angles bent downwards, so that, though the ischia make with each other an angle of about 90°, the fronts of the pubis are nearly in line. There is a round pubic foramen. The ischium is, as usual in the plate-like type, longer than broad.

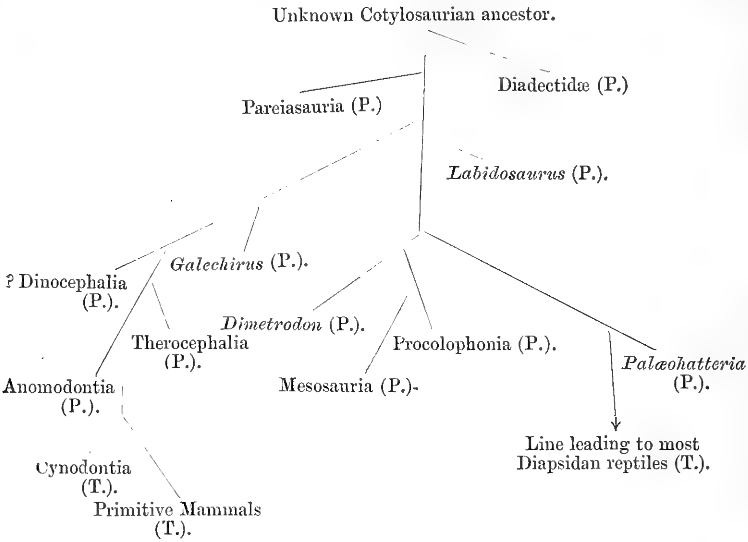
The pelvis in the typical Therocephalians is unknown. In the Dinocephalian *Titanosuchus* the ilium is directed mainly upwards and has a short crest. The pubis and ischium are unknown.

In the Anomodontia the pelvis is well known in a number of genera. The type seen in *Oudenodon* differs little from that of the other known forms. The ilium is directed well forwards and has a large crest very like that in some Mammals. The pubis and ischium are somewhat removed from the plate-like type. The foramen, though small, lies between the pubis and ischium, and is thus a true obturator foramen.

In the Cynodonts the pelvis is well known in *Cynognathus* (17) and *Diademodon* (27), and less perfectly in some other genera. In general, the structure is strikingly mammal-like. The ilium is directed mainly forwards and has a very long crest. The pubis and ischium are almost typically mammalian, owing to the presence of a large obturator foramen.

From the consideration of the comparative anatomy of these skeletal structures it will be seen that the mammal-like reptiles form a well-defined group, whose earlier members show so much affinity with the primitive Diaptosaurians and with the higher Cotylosaurians as to render it highly probable that from some Cotylosaurian ancestor all the later reptiles are descended. On the other hand, the higher mammal-like reptiles approach so closely to the mammals that it is not always possible to distinguish between them. *Tritylodon* is held by many to be a reptile; by others it is believed to be a mammal. *Dromatherium*, *Microconodon*, and *Karoomys* are generally believed to be mammals, but it is just possible they may be reptiles; while *Sesamodon* and *Melinodon*, which are believed to be Cynodont reptiles, may possibly prove to be mammals. The difference between a Cynodont reptile and a Monotreme is less than the difference between a Monotreme and a Marsupial, and this again is not much greater than that between a Marsupial and an Insectivore.

The relationships of the various groups dealt with above may be represented by the following diagram :—



"P." signifies that the types or groups occur in the Permian beds; "T." that they first occur in Triassic beds.

Literature referred to.

1. R. Broom.—"On the Origin of Mammals." Papers read at the Joint Meeting of the Brit. & S. Afr. Assoc. in S. Africa, 1905, vol. iii. Johannesburg, 1907.
2. R. Owen.—"Report on the Rept. Fossils of S. Africa, &c." Tr. Geol. Soc. Lond. 1845.
3. E. D. Cope.—"On the Theromorphous Reptilia." Am. Nat. 1878.
4. G. Baur & E. C. Case.—"On the Morphology of the Skull of the Pelycosauria and the Origin of Reptiles." Anat. Anz. 1897.
5. H. F. Osborn.—"The Reptilian Subclasses Diapsida and Synapsida, and the Early History of the Diaptosauria." Mem. Am. Mus. Nat. Hist., New York, 1903.
6. G. A. Boulenger.—"On the Characters and Affinities of the Triassic Reptile *Telerpeton elginense*." P. Z. S. London, 1904.
7. R. Broom.—"On the Use of the Term Anomodontia." Rec. Alb. Mus. 1905.

8. H. G. SEELEY.—"On the Therosuchia." Phil. Trans. 1904.
9. F. BROILI.—"Permische Stegocephalen und Reptilien aus Texas." Palæontograph. 1903.
10. R. BROOM.—"On the Pareiasaurian Genus *Propappus*." Ann. S. Afr. Mus. 1907.
11. R. BROOM.—"On some new Fossil Reptiles from Victoria West." Tr. S. Afr. Phil. Soc. 1907.
12. H. G. SEELEY.—"On Parts of the Skeleton of a Mammal, &c. (*Theriodesmus phylarchus*)." Phil. Trans. 1888.
13. R. BROOM.—"On an almost perfect Skull of a new Primitive Theriodont (*Lycosuchus vanderrieti*)." Tr. S. Afr. Phil. Soc. 1903.
14. R. BROOM.—"On some new Therocephalian Reptiles." Tr. S. Afr. Phil. Soc. 1907.
15. R. BROOM.—"On *Ictidosuchus primævus*." Tr. S. Afr. Phil. Soc. 1902.
16. R. BROOM.—"On the Structure of the Shoulder-Girdle in *Lystrosaurus*." Ann. S. Afr. Mus. 1903.
17. H. G. SEELEY.—"On the Skeleton of new Cynodontia." Phil. Trans. 1895.
18. R. BROOM.—"On a new Cynodont Reptile (*Ælurosuchus browni*)." Tr. S. Afr. Phil. Soc. 1906.
19. R. BROOM.—"On the Development and Morphology of the Marsupial Shoulder-Girdle." Tr. Roy. Soc. Edinb. 1899.
20. E. C. CASE.—"A Re-description of *Pariotichus incisivus* Cope." Zool. Bulletin, Boston, 1899.
21. E. C. CASE.—"On the Structure of the Fore Foot of *Dimetrodon*." Journ. Geol. Chicago, 1904.
22. R. BROOM.—"On the Remains of *Procolophon* in the Albany Museum." Rec. Alb. Mus. 1903.
23. R. BROOM.—"The Origin of the Mammalian Carpus and Tarsus." Tr. S. Afr. Phil. Soc. 1904.
24. H. G. SEELEY.—"On the Gomphodontia." Phil. Trans. 1895.
25. E. C. CASE.—"The Osteology of *Embolophorus dollovianus* Cope, &c." Journ. Geol. 1903.
26. R. BROOM.—"On an almost perfect Skeleton of *Pareiasaurus serridens* Owen." Ann. S. Afr. Mus. 1903.
27. R. BROOM.—"On some Points in the Anatomy of the Theriodont Reptile *Diademodon*." P. Z. S. Lond. 1905.

2. A Revision of the African Silurid Fishes of the Subfamily *Clariinæ*. By G. A. Boulenger, F.R.S., V.P.Z.S.

[Received November 11, 1907.]

(Text-figures 248–257.)

The Silurid Fishes of the Subfamily *Clariinæ* are one of the most interesting, but at the same time most difficult groups of the African fresh waters. Many of the species of *Clarias* are so closely related, so difficult to define, and show so much individual variation in characters which have been regarded as specific, that I have felt compelled to take up their study as if they had never been classified before. I hope the revision which I now offer will place the determination of the species on a sounder footing.

The group is of special interest from an evolutionary point of view, the series *Clarias—Allabenchelys—Clariallabes—Gymnallabes—Channallabes* forming what may be termed an orthogenetic series * leading from a more typical Cat-fish to one that is truly Eel-like, with almost every link in the chain connecting the two extremes. A few of these types are represented on the subjoined text-figures.

The eel-shape has been reached, in this series, by an elongation of the caudal part of the body concurrently with the fusion of the dorsal and anal fins with the caudal, and the reduction and final suppression of the paired fins, the ventrals first, followed by the pectorals. At the same time the bony buckler which so efficiently protects the head of the typical *Clarias* has been gradually reduced until its complete suppression in the most elongate forms, *Gymnallabes* and *Channallabes*.

I do not believe for one moment that the more generalised forms here described represent the actual ancestors of the terminal type, as it is not likely that they should coexist at the present day; but I regard the apparent links of the chain as side branches of a continuous stem, as the close allies of these extinct forms, and for the purpose of the study of the lines of derivation they are just as good examples as if they were the actual ancestors, because they must be so very similar to them. Even in palæontological series, what we usually regard as continuous series are surely mostly made up of such elements; except in the case of varieties we have no evidence of any one form having turned into another, evolution being after all still a hypothesis,—the only workable hypothesis, built up on concurring and converging probabilities.

It is sometimes the case that an orthogenetic series is susceptible of being interpreted in a reversed direction. But this

* The term 'Orthogenesis' has been invented by Haacke in 1893, and has gained wide circulation through the writings of Eimer. It is intended to express determinate evolution, as opposed to the Darwinian idea of random variation leading to the formation of new types. In orthogenetic series the evolution of the organism is pushed on in one direction without adaptation having to intervene, although the ultimate result is an adaptation.

surely cannot happen in this instance, and the *Clariinæ* therefore teach us that a head protected by a bony buckler may gradually transform into one which is entirely devoid of such protection, a process of evolution which I am convinced has taken place in many and diverse groups of lower Vertebrates.

I have recently adduced this example of the *Clariinæ* in endeavouring to refute Prof. von Méhely's inacceptable theory that, in the group of *Lacerta muralis*, the more feebly ossified skulls represent the more primitive types. In a recent reply to my criticisms *, my distinguished colleague of Budapest more clearly expresses his general views on evolution. As he thinks that the lizards with toothless palate are the oldest ("dass die Stammform noch keine Gaumenzähne besass," p. 474), that the pterygoid teeth were acquired by the later forms, and as he endorses the extraordinary Jaeckelian hypothesis of fishes having been derived from land Vertebrates (*Prototetrapoda*), I fear further discussion with him on such matters would be mere waste of time. Nor can I feel sympathy for innovations in classification which are expressed by such barbarous terms as *Neolacertæ* and *Archæolacertæ*.

CLARIINÆ.

Synopsis of the Genera.

A. Dorsal fin single, formed entirely of articulated rays.

1. Eye with a free border; pectoral and ventral fins well developed.

Sides of head protected by bony shields .... 1. *Clarias* Gron.

Sides of head naked, only the postorbital shield being present .... 2. *Allabenchelys* Blgr.

2. Eye without free border; sides of head naked.

Postorbital shield present; pectoral fins well developed, ventrals small .... 3. *Clariallabes* Blgr.

Postorbital shield absent; pectoral and ventral fins very small .... 4. *Gymnallabes* Gthr.

Postorbital shield absent; pectoral fins rudimentary or absent, ventrals absent .... 5. *Channallabes* Gthr.

B. Dorsal fin divided into two, the posterior portion adipose.

Sides of head protected by bony shields; adipose dorsal fin large and supported by bony rays (the produced neural spines) .... 6. *Heterobranchus* Geoffr.

Sides of head naked, only the postorbital shield being present; adipose dorsal fin small .... 7. *Dinotopterus* Blgr.

1. Clarias.

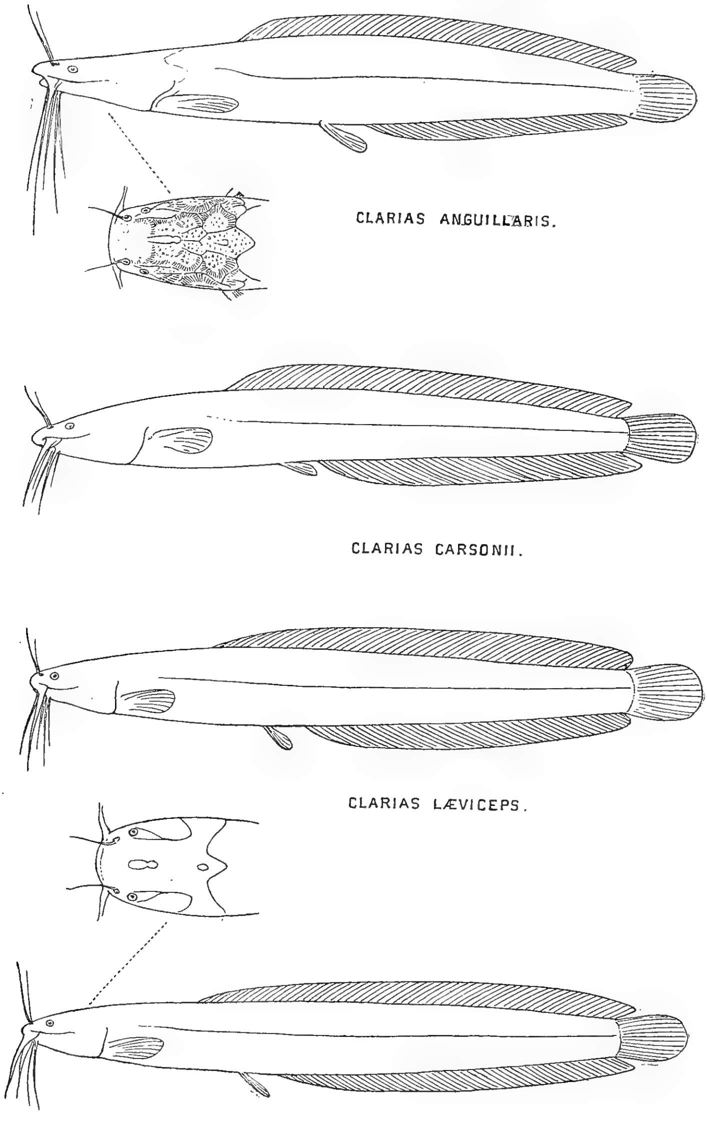
Gronovius, Zoophyl. p. 100 (1781); Günther, Cat. Fishes, v. p. 248 (1864); Boulenger, Poiss. Bass. Congo, p. 248 (1901), and Fishes of the Nile, p. 278 (1907).

Macropteronotus, part., Lacepède, Hist. Poiss. v. p. 84 (1803).

South-Eastern Asia, Syria, and Africa. 32 species are known from the latter part of the world.

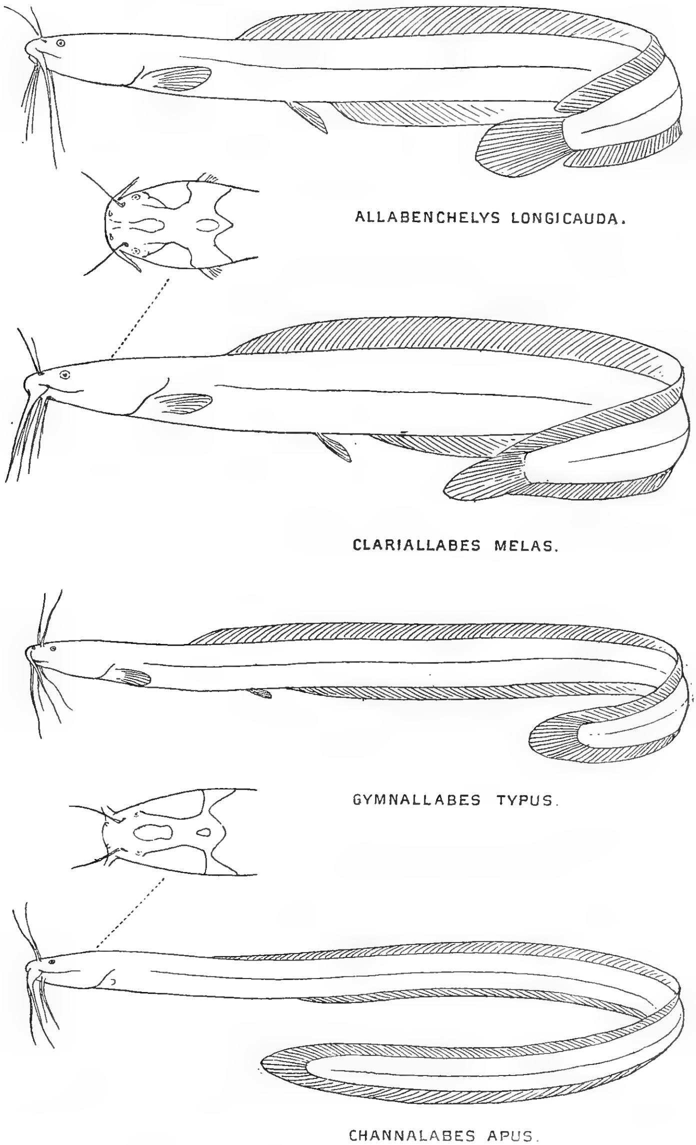
* Ann. Mus. Hung. v. 1907, p. 469.

Text-fig. 248.



Showing gradual transition from typical *Clarias*

Text-fig. 249.



to Eel-shaped form, *Channalabes*.

Synopsis of the Species.

I. Ventral fins midway between end of snout and root of caudal, or a little nearer (less than $\frac{1}{3}$) the former; nasal barbel shorter than head *.

A. Maxillary barbel not or but little longer than head, except in the very young; at least 20 gill-rakers on anterior arch.

1. Length of head 3 to $3\frac{3}{4}$ times in total length †; vomerine teeth forming an uninterrupted or scarcely interrupted band or patch; distance between occipital process and dorsal fin at least 4 times in length of head.

a. Head granulate above, except in the very young; D. 62–82; A. 46–65.

α. Vomerine teeth mostly pointed or granular-subconical, forming a band which is not broader than the band of præmaxillary teeth; distance between occipital process and dorsal fin 4 to 7 times in length of head.

20–27 gill-rakers on anterior arch; distance between dorsal and caudal $1-1\frac{1}{2}$ diameters of eye .... 1. *C. anguillaris* L.

40–50 gill-rakers on anterior arch; distance between dorsai and caudal 1–2 diameters of eye .... 2. *C. gariepinus* Burch.

87 gill-rakers on anterior arch; distance between dorsal and caudal 3 diameters of eye .... 3. *C. moorii* Blgr.

β. Vomerine teeth all or mostly granular, forming a crescentic band with or without posterior process.

30–40 gill-rakers on anterior arch; band of vomerine teeth as broad as or a little narrower than band of præmaxillary teeth; head not more than $1\frac{2}{3}$ as long as broad, 4–7 times its distance from dorsal.. 4. *C. senegalensis* C. & V.

25 (in very young)–110 gill-rakers on anterior arch; band of vomerine teeth nearly 1 to $1\frac{1}{2}$ as broad as præmaxillary band; head not more than $1\frac{2}{3}$ as long as broad, 4–7 times its distance from dorsal......... 5. *C. mossambicus* Peters.

90 gill-rakers on anterior arch; band of vomerine teeth as broad as præmaxillary band; head $1\frac{5}{7}$ as long as broad, 9 times its distance from dorsal ... 6. *C. vinciguerræ* Blgr.

35 (in very young)–135 gill-rakers on anterior arch; band of vomerine teeth $1\frac{1}{3}$ to $2\frac{1}{2}$ times width of præmaxillary band; head not more than $1\frac{2}{3}$ as long as broad, 4–7 times its distance from dorsal......... 7. *C. lazera* C. & V.

γ. Vomerine teeth granular, forming a large semi-elliptic patch, squarely truncate behind, its longitudinal diameter 3 times that of præmaxillary band; 35 gill-rakers on anterior arch; distance between dorsal and caudal $\frac{1}{4}$ length of head .... 8. *C. mellandi* Blgr.

b. Head smooth above; D. 78–85, A. 60–70; vomerine teeth granular, forming a band which is not broader than præmaxillary band; 45–70 gill-rakers on anterior arch; distance between dorsal and caudal not greater than diameter of eye .... 9. *C. tsanensis* Blgr.

2. Length of head 4 times in total length; vomerine teeth mostly granular, forming a band which is a little narrower than the præmaxillary band and interrupted in the middle; head granulate above; D. 63–72, A. 50–52; distance between occipital process and dorsal $\frac{2}{7}$–$\frac{1}{3}$ length of head; 55 gill-rakers on anterior arch .... 10. *C. capensis* C. & V.

B. Maxillary barbel $1\frac{1}{3}$ length of head; 12 gill-rakers on anterior arch; head feebly granulate above, $1\frac{1}{4}$ as long as broad; vomerine teeth conical; D. 65–70, A. 56–62 .... 11. *C. platycephalus* Blgr.

---

* The head is measured to the extremity of the occipital process.
† Caudal fin not included.

II. Ventral fins once and $\frac{1}{4}$ to twice as distant from root of caudal as from end of snout, *or* nasal barbel at least as long as head; head smooth or very feebly granulate above; less than 30 gill-rakers on anterior arch.

A. Dorsal separated from caudal by a space at least equal to diameter of eye; nasal barbel shorter than head.

1. Maxillary barbel shorter than head; head $1\frac{1}{5}$–$1\frac{1}{3}$ as long as broad, its length 4–5 times in total length; distance between occipital process and dorsal $\frac{2}{5}$–$\frac{3}{5}$ length of head; 10–13 gill-rakers on anterior arch; D. 65–78, A. 57–64.

Maxillary barbel $\frac{3}{5}$–$\frac{3}{4}$ length of head, not reaching beyond gill-opening .... 12. *C. carsonii* Blgr.

Maxillary barbel $\frac{5}{6}$ length of head, reaching a little beyond base of pectoral .... 13. *C. poensis* Blgr.

2. Maxillary barbel as long as or a little longer than head; distance between occipital process and dorsal $\frac{2}{5}$–$\frac{2}{3}$ length of head, which is 4–5 times in total length.

Head $1\frac{1}{3}$ as long as broad; D. 75–84, A. 60–70; 10 gill-rakers on anterior arch .... 14. *C. submarginatus* Peters.

Head $1\frac{1}{4}$–$1\frac{1}{3}$ as long as broad; D. 70–72, A. 50–58; 13–15 gill-rakers on anterior arch .... 15. *C. liocephalus* Blgr.

Head slightly longer than broad; D. 58–60, A. 40–42; 20 gill-rakers on anterior arch .... 16. *C. breviceps* Blgr.

3. Maxillary barbel once and $\frac{1}{2}$ to twice as long as head; head $1\frac{1}{5}$–$1\frac{1}{3}$ as long as broad; 12–15 gill-rakers on anterior arch.

Length of head 4–$4\frac{1}{2}$ times in total; distance between occipital process and dorsal $\frac{1}{3}$–$\frac{1}{2}$ length of head; distance between ventrals and caudal $1\frac{1}{3}$–$1\frac{2}{5}$ that between end of snout and ventrals; D. 70–80, A. 52–60 .... 17. *C. walkeri* Gthr.

Length of head 5–$5\frac{1}{2}$ times in total; distance between occipital process and dorsal $\frac{3}{5}$–$\frac{2}{3}$ length of head; distance between ventrals and caudal at least $1\frac{2}{3}$ that between end of snout and ventrals; D. 80, A. 70–73.. 18. *C. longior* Blgr.

B. Dorsal and anal in contact with or very narrowly separated from, but not adnate to the caudal; maxillary barbel longer than head.

1. Nasal barbel at least as long as head, which is $1\frac{1}{3}$–$1\frac{1}{2}$ as long as broad; distance between occipital process and dorsal $\frac{1}{5}$–$\frac{1}{3}$ length of head.

a. Vomerine teeth conical or subgranular, in a crescentic band.

Length of head $3\frac{1}{2}$–$4\frac{1}{5}$ times in total; maxillary barbel $1\frac{1}{2}$–$1\frac{2}{3}$ length of head; 20–25 gill-rakers on anterior arch; D. 70–82, A. 55–63 .... 19. *C. angolensis* Stdr.

Length of head 4–$4\frac{1}{4}$ times in total; maxillary barbel 2–$2\frac{1}{2}$ length of head; 17–22 gill-rakers on anterior arch; D. 78–87, A. 55–67 .... 20. *C. bythipogon* Sauv.

Length of head 4–$4\frac{1}{2}$ times in total; maxillary barbel $1\frac{1}{2}$–$1\frac{2}{3}$ length of head; 14–15 gill-rakers on anterior arch; D. 65–78, A. 55–62; occipital process much longer than broad .... 21. *C. alluaudi* Blgr.

Length of head $4\frac{1}{2}$–5 times in total; maxillary barbel $1\frac{1}{3}$–2 length of head; 16–18 gill-rakers on anterior arch; D. 82–91, A. 68–72 .... 22. *C. werneri* Blgr.

b. Vomerine teeth granular, in a fan-shaped patch; length of head 4 times in total; maxillary barbel $1\frac{1}{2}$ length of head; 15 gill-rakers on anterior arch; D. 80, A. 63 .... 23. *C. macromystax* Gthr.

2. Nasal barbel shorter than head.

a. Length of head $3\frac{1}{2}$–$4\frac{1}{2}$ times in total; distance between occipital process and dorsal $\frac{2}{5}$–$\frac{2}{3}$ length of head; D. 60–72, A. 44–55.

Pectoral spine strongly serrated on both sides; 12–15 gill-rakers on anterior arch .... 24. *C. dumerilii* Stdr.

Pectoral spine feebly serrated; 20 gill-rakers on anterior arch .... 25. *C. liberiensis* Stdr.

b. Length of head $4\frac{2}{3}$–$5\frac{1}{2}$ times in total; D. 78–87, A. 68–80; 15–20 gill-rakers on anterior arch.

Head $1\frac{2}{5}$–$1\frac{1}{2}$ as long as broad; nasal barbel $\frac{3}{4}$–$\frac{4}{5}$ length of head .... 26. *C. pachynema* Blgr.

Head $1\frac{1}{4}$–$1\frac{1}{3}$ as long as broad; nasal barbel $\frac{1}{2}$–$\frac{2}{3}$ length of head .... 27. *C. læviceps* Gill.

C. Dorsal and anal embracing and adnate to base of caudal; maxillary barbel $\frac{4}{5}$–$1\frac{1}{3}$ length of head.

1. Head $1\frac{1}{4}$–$1\frac{1}{3}$ as long as broad.

Length of head 4 times in total; ventrals a little nearer end of snout than caudal; D. 55, A. 50; pectoral spine not serrated on outer side .... 28. *C. buettikoferi* Stdr.

Length of head 5 times in total; distance between ventrals and caudal $1\frac{1}{2}$ that between ventrals and end of snout; D. 80, A. 65; 15 gill-rakers on anterior arch; pectoral spine serrated on both sides .... 29. *C. amplexicauda* Blgr.

2. Head $1\frac{2}{5}$ to $1\frac{1}{2}$ as long as broad.

Length of head $4\frac{1}{2}$–$5\frac{1}{4}$ times in total, 3 times its distance from dorsal; distance between ventrals and caudal $1\frac{1}{2}$ that between ventrals and end of snout; maxillary barbel as long as or a little longer than head; D. 80–90, A. 67–73; 12 gill-rakers on anterior arch; pectoral spine not serrated on outer side .... 30. *C. theodoræ* M. Web.

Length of head 5 times in total, 3 times its distance from dorsal; distance between ventrals and caudal $1\frac{3}{4}$ that between ventrals and end of snout; maxillary barbel a little shorter than head; D. 83, A. 68; 20 gill-rakers on anterior arch; pectoral spine not serrated on outer side .... 31. *C. fouloni* Blgr.

Length of head 5–6 times in total, $1\frac{1}{2}$–$1\frac{2}{3}$ its distance from dorsal; distance between ventrals and caudal $1\frac{2}{3}$ that between ventrals and end of snout; maxillary barbel a little longer than head; D. 89–93, A. 70–78; 8–10 gill-rakers on anterior arch; pectoral spine serrated on outer side .... 32. *C. salæ* Hubr.

1. Clarias anguillaris.

Silurus anguillaris Linnæus, in Hasselquist, Reise Palæst. p. 415 (1762), and Syst. Nat. i. p. 502 (1766).

Macropteronotus charmuth, part., Lacepède, Hist. Poiss. v. p. 85 (1803).

Macropteronotus anguillaris, part., Rüppell, Beschr. n. Fische Nil, p. 5 (1829).

Clarias hasselquistii Cuvier & Valenciennes, Hist. Poiss. xv. p. 362, pl. ccccxlvi. (1840).

Clarias anguillaris Günther, Cat. Fish. v. p. 14 (1864); Peters, Reise Mossamb. iv. p. 36 (1868); Günther, Petherick's Trav. ii. p. 217 (1869); Panceri, Rend. Acc. Sc., Soc. R. Nap. xii. 1873, p. 110; Boulenger, Fish. Nile, p. 280, pl. xlix. (1907).

Clarias parvimanus Günther, opp. cit. pp. 15, 218.

Depth of body $5\frac{1}{3}$ to $7\frac{3}{4}$ times in total length, length of head 3 to $3\frac{3}{4}$ times. Head $1\frac{1}{2}$ to $1\frac{2}{3}$ times as long as broad, its upper surface coarsely granulate in the adult; occipital process angular; frontal fontanelle elliptical, sole-shaped or knife-shaped, 3 to 5 times as long as broad, $3\frac{1}{2}$ to 5 times in length of head; occipital fontanelle small, in advance of the occipital process; eye 2 (very young) to $4\frac{1}{2}$ times in length of snout, 3 to 9 times in interorbital width; width of mouth nearly equal to interorbital width; band of præmaxillary teeth $5\frac{1}{2}$ to 8 times as long as broad; vomerine teeth mostly conical, sometimes subgranular behind, forming a crescentic, continuous or narrowly interrupted band which is as broad as or narrower than præmaxillary band; nasal barbel $\frac{1}{4}$ to $\frac{2}{5}$ length of head ($\frac{1}{2}$ to $\frac{2}{3}$ in the very young); maxillary barbel $\frac{3}{5}$ to $\frac{5}{6}$ length of head ($\frac{3}{4}$ to once and $\frac{1}{5}$ in the very young), reaching gill-opening or extremity of pectoral spine; outer mandibular barbel $1\frac{1}{4}$ to $1\frac{1}{2}$ times as long as inner, which measures $\frac{1}{3}$ to $\frac{2}{5}$ length of head ($\frac{2}{3}$ to nearly once in the very young). Gill-rakers rather short, 20 to 27 on anterior arch. Clavicles hidden under the skin. Dorsal 65 to 76, its distance from occipital process $\frac{1}{7}$ to $\frac{1}{4}$ length of head, its distance from caudal fin 1 to $2\frac{1}{2}$ diameter of eye. Anal fin with 53 to 62 rays, narrowly separated from caudal. Pectoral $\frac{2}{5}$ to $\frac{1}{2}$ length of head, the spine serrated on the outer border and $\frac{1}{2}$ (young) to $\frac{2}{3}$ the length of the fin. Ventral slightly nearer end of the snout than root of caudal. Caudal not quite half length of head. Upper parts olive or dark brown, uniform or with darker marblings, lower parts white; a more or less distinct dark band on each side of the lower surface of the head; fins dark, edged with yellow or orange, sometimes with small black spots.

Reaches a length of 750 millimetres.

Nile, Lake Victoria.

2. Clarias gariepinus.

Silurus (*Heterobranchus*) *gariepinus* Burchell, Trav. Int. S. Afr. i. p. 425, fig. (1822).

Clarias capensis (non C. & V.) A. Smith, Ill. Zool. S. Afr., Pisc. pl. xxvii. (1845).

Clarias mossambicus, part., Peters, Mon. Berl. Ac. 1852, p. 682, and Reise Mossamb. iv. p. 32, pl. vi. figs. 1 & 2, and pl. vii. figs. 2 & 3 (1868).

Clarias gariepinus Günther, Cat. Fish. v. p. 14 (1864); M. Weber, Zool. Jahrb., Syst. x. 1897, p. 149; Boulenger, Poiss. Bass. Congo, p. 254 (1901).

Depth of body $6\frac{1}{2}$ to 7 times in total length, length of head 3 to $3\frac{1}{2}$ times. Head $1\frac{3}{5}$ to $1\frac{2}{3}$ times as long as broad, its upper surface coarsely granulate in the adult; occipital process angular; frontal fontanelle 3 to $3\frac{1}{2}$ times as long as broad, 4 times in length of head; occipital fontanelle very small, in advance of occipital process; eye very small, 3 times in length of snout and 5 or 6 times in interorbital width in the adult; width of mouth nearly equal to interorbital width, $\frac{2}{5}$ length of head; band of præmaxillary teeth 5 or 6 times as long as broad; vomerine teeth mostly conical, or granular-subconical, forming a crescentic band, which may be slightly interrupted in the middle, where it is nearly as broad as or narrower than præmaxillary band; nasal barbel $\frac{1}{5}$ to $\frac{1}{3}$ length of head; maxillary barbel a little shorter than head, reaching base or second third of pectoral spine; outer mandibular barbel about $1\frac{1}{2}$ as long as inner, which measures $\frac{1}{2}$ to $\frac{2}{3}$ length of head. Gill-rakers on first arch fine and close-set, 40 to 50 in number. Clavicles not exposed. Dorsal 68–79, its distance from occipital process $\frac{1}{5}$ to $\frac{1}{4}$ length of head, its distance from caudal greater than diameter of eye. Anal 53–60, not reaching caudal. Pectoral $\frac{2}{5}$ to $\frac{1}{2}$ length of head, the spine serrated on the outer border, $\frac{2}{3}$ or $\frac{3}{4}$ the length of the fin. Ventral nearly equally distant from end of snout and from caudal. Caudal about $\frac{1}{2}$ length of head. Olive above, uniform or marbled with dark brown, white below.

Total length 620 millim.

South Africa (Orange River, Natal, Transvaal), Mozambique, Angola.

3. Clarias moorii.

Boulenger, Ann. & Mag. N. H. (7) viii. 1901, p. 13, and Fish. Nile, p. 283, pl. l. (1907).

Depth of body nearly 7 times in total length, length of head $3\frac{1}{4}$ times. Head once and $\frac{3}{5}$ as long as broad, its upper surface coarsely granulate; occipital process angular, a little longer than broad; frontal fontanelle knife-shaped, thrice as long as broad, nearly 4 times in length of the head; occipital fontanelle small, in advance of occipital process; eye $3\frac{1}{3}$ times in length of snout, $6\frac{2}{3}$ times in interorbital width; width of the mouth nearly equal to interorbital width; band of præmaxillary teeth 6 times as long as broad; vomerine teeth mostly pointed, a few in the middle granular, forming a crescentic band which is as broad as the præmaxillary band. Nasal barbel $\frac{1}{5}$ length of head; maxillary barbel a little more than half length of head, extending to root of pectoral; outer mandibular barbel once and $\frac{1}{2}$ as long as inner, which measures nearly $\frac{1}{3}$ length of head. Gill-rakers long and closely set, 87 on anterior arch. Clavicles striated, distinct under the thin skin. Dorsal 66, its distance from occipital process $\frac{1}{5}$ length of head, its distance from caudal fin 3 times length of eye. Anal 54, separated from the caudal by a distinct interspace. Pectoral fin nearly half length of head, the spine serrated on the outer border and $\frac{2}{3}$ the length of the fin. Ventral a little nearer end of the snout than root of caudal. Caudal about half length of head. Olive-brown above, white beneath.

Total length 590 millim.

Lake Albert Edward.

4. Clarias senegalensis.

Clarias senegalensis Cuvier & Valenciennes, Hist. Poiss. xv. p. 376 (1840); Steindachner, Sitzb. Ak. Wien, lx. i. 1869, p. 978.

Clarias anguillaris, part., Günther, Cat. Fish. v. p. 14 (1864).
Clarias budgetti Boulenger, Proc. Zool. Soc. 1900, p. 513.

Depth of body $6\frac{1}{2}$ to $7\frac{1}{2}$ times in total length, length of head 3 to $3\frac{2}{3}$ times. Head $1\frac{1}{2}$ to $1\frac{2}{3}$ times as long as broad, upper surface more or less coarsely granulate in the adult; occipital process angular; frontal fontanelle sole-shaped, 3 to 5 times as long as broad, 4 to $4\frac{1}{2}$ times in length of head; occipital fontanelle very small, in advance of occipital process; eye small, 3 to 4 times in length of snout, $5\frac{1}{2}$ to 7 times in interorbital width in the adult; width of mouth nearly equal to interorbital width, $\frac{2}{5}$ length of head; band of præmaxillary teeth 6 to 8 times as long as broad; vomerine teeth mostly granular, forming a crescentic band, which is as broad as or a little narrower than the præmaxillary band; nasal barbel $\frac{1}{3}$ to $\frac{1}{2}$ length of head; maxillary barbel $\frac{3}{4}$ to once length of head (a little longer in the young), reaching about middle or end of pectoral spine; outer mandibular barbel $1\frac{1}{4}$ to $1\frac{1}{2}$ times as long as inner, which measures $\frac{2}{5}$ to $\frac{2}{3}$ length of head. Gill-rakers on first arch fine and closely set, 30 to 40 in number. Clavicles striated and covered with thin skin. Dorsal 65–80, its distance from the occipital process $\frac{1}{7}$ to $\frac{1}{4}$ length of head, its distance from caudal not or but little greater than diameter of eye. Anal 46–58, narrowly separated from caudal. Pectoral nearly $\frac{1}{2}$ length of head, the spine serrated on the outer border, $\frac{2}{3}$ the length of the fin. Ventrals midway between end of snout and caudal or a little nearer the former. Caudal about $\frac{1}{2}$ length of head. Olive or dark brown above, with or without darker spots or marblings, white beneath; anal with a light edge.

Total length 850 millim.

Senegal, Gambia, Niger. Type (in Paris Mus.), stuffed, examined.

5. Clarias mossambicus.

Clarias mossambicus, part., Peters, Mon. Berl. Ac. 1852, p. 682, and Reise Mossamb. iv. p. 32, pl. vi. fig. 3 (1868).

Clarias gariepinus, part., Günther & Playfair, Fish. Zanzib. p. 113 (1866).

Clarias mossambicus Fischer, Jahrb. Hamb. Wiss. Anst. i. 1884, p. 28; Vinciguerra, Ann. Mus. Genova (2) xv. 1895, p. 31, fig. 1, and xvii. 1896, p. 25; Pfeffer, Thierw. O.-Afr., Fische, p. 27, fig. (1896); Pellegrin, Mém. Soc. Zool. France, xvii. 1905, p. 176.

Clarias robecchii Vinciguerra, Ann. Mus. Genova (2) xiii. 1893, p. 450, and xv. 1895, p. 30, fig.; Boulenger, Poiss. Bass. Congo, p. 253 (1901), and Fish. Nile, p. 285, pl. li. fig. 1 (1907).

Clarias lazera (non Cuvier & Valenciennes) Günther, Proc. Zool. Soc. 1894, p. 89; Boulenger, Proc. Zool. Soc. 1901, ii. p. 161.

Clarias smithii Günther, Proc. Zool. Soc. 1896, p. 219, fig.

Clarias microphthalmus Pfeffer, op. c. p. 28; Hilgendorf, Zool. Jahrb., Syst. xxii. 1905, p. 410.

Clarias güntheri Pfeffer, l. c.

Depth of body 6 to 8 times in total length, length of head 3 to $3\frac{2}{3}$ times. Head $1\frac{1}{2}$ to $1\frac{2}{3}$ times as long as broad, its upper surface coarsely granulate in the adult; occipital process angular; frontal fontanelle sole-shaped or knife-shaped, $2\frac{1}{2}$ to 4 times as long as broad, $3\frac{1}{2}$ to $5\frac{1}{2}$ times in length of head; occipital fontanelle small, in advance of occipital process; eye $2\frac{1}{2}$ (young) to 4 times in length of the snout, 4 (young) to 8 times in interorbital width; width of mouth equal to or a little less than interorbital width; band of præmaxillary teeth 4 (young) to 8 times as long as broad; vomerine teeth granular, forming a crescentic band with or without a short posterior median process, this band 1 to $1\frac{1}{2}$ times the width of the præmaxillary band; nasal barbel $\frac{1}{5}$ to $\frac{2}{5}$ length of head ($\frac{1}{2}$ to $\frac{2}{3}$ in the very young); maxillary barbel $\frac{2}{3}$ to once length of head (a little longer in the very young), not extending beyond middle of pectoral fin; outer mandibular barbel $1\frac{1}{4}$ to $1\frac{3}{5}$ times as long as inner, which measures $\frac{1}{2}$ to $\frac{3}{4}$ length of head. Gill-rakers long and closely set, 25 (very young) to 110 on anterior arch. Clavicles hidden under the skin. Dorsal 62 to 78, its distance from occipital process $\frac{1}{7}$ to $\frac{1}{4}$ length of head, its distance from caudal fin one to two diameters of eye. Anal 50 to 62, separated from the caudal by a distinct interspace. Pectoral $\frac{2}{5}$ to $\frac{1}{2}$ length of head, the spine serrated on the outer border and $\frac{3}{5}$ to $\frac{3}{4}$ the length of the fin. Ventral equally distant from end of snout and from root of caudal, or a little nearer the former. Caudal $\frac{2}{5}$ to $\frac{1}{2}$ length of head. Olive to blackish above, white beneath; a more or less distinct dark band on each side of the lower surface of the head.

Total length 650 millim.

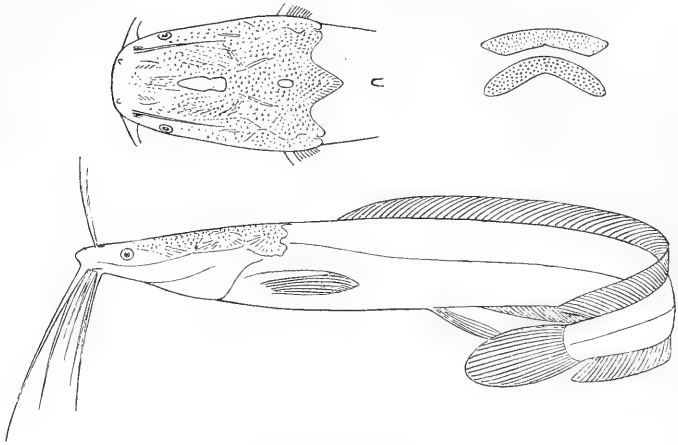
East Africa, from Abyssinia and Lake Victoria to Lake Tanganyika and the Zambesi.

6. CLARIAS VINCIGUERRÆ.

Boulenger, Ann. & Mag. N. H. (7) x. 1902, p. 438.

Depth of body 7 times in total length, length of head 3 times. Head $1\frac{5}{7}$ times as long as broad, upper surface strongly granulated; occipital process angular; frontal fontanelle knife-shaped, $3\frac{1}{2}$ times as long as broad, $4\frac{1}{2}$ times in length of head; occipital fontanelle small, in advance of occipital process; eye small, 3 times in length of snout, $5\frac{1}{2}$ times in interorbital width; width of mouth a little less than interorbital width, $\frac{2}{5}$ length of head. Band of præmaxillary teeth $5\frac{1}{2}$ times as long as broad; vomerine teeth granular, forming a crescentic band which is as broad as the præmaxillary band. Nasal barbel nearly $\frac{2}{5}$ length of head; maxillary barbel slightly shorter than head, reaching base of pectoral fin; outer mandibular barbel $\frac{2}{3}$ length of head, inner $\frac{2}{5}$. Gill-rakers fine and closely set, about 90 on first arch. Dorsal 67, its distance from the occipital process $\frac{1}{9}$ length of head, its distance from the caudal 2 diameters of eye. Anal 53, narrowly separated from caudal. Pectoral not quite $\frac{1}{2}$ length of head, the spine finely serrated on the outer border, $\frac{5}{7}$ the length of the fin. Ventral a little nearer end of snout than caudal. Latter nearly $\frac{1}{2}$ length

Text-fig. 250.



Clarias vinciguerræ.

of head. Dark brown above, whitish beneath; anal and caudal with a fine light edge.

Total length 410 millim.

Kassam River at Awhorra Mullka, Shoa, about 4000 feet.

7. CLARIAS LAZERA.

Silurus anguillaris (non Linnæus) A. Russell, Nat. Hist. Aleppo, 2nd ed. ii. p. 217, pl. viii. (1794).

Macropteronotus charmuth, part., Lacepède, Hist. Poiss. v. p. 85 (1803).

Heterobranchus anguillaris (non Linnæus) I. Geoffroy, Descr. Egypte, Poiss. p. 305, pl. xvi. fig. 1 (1827); Joannis, Mag. Zool. 1835, pl. xiv.

Garmout Laséra, Rifaud, Voy. Egypte, pl. cxcv. (1830).

Clarias lazera Cuvier & Valenciennes, Hist. Poiss. xv. p. 372 (1840); Günther, Cat. Fish. v. p. 16 (1864); Peters, Reise Mossamb. iv. p. 36 (1868); Günther, Petherick's Trav. ii. p. 218 (1869); Boulenger, Poiss. Bass. Congo, p. 252 (1901); Hilgendorf, Zool. Jahrb., Syst. xxii. 1905, p. 409; Boulenger, Fish. Nile, p. 288, pl. lii. (1907).

Clarias syriacus Cuvier & Valenciennes, t. c. p. 375.

Clarias capensis (non Cuvier & Valenciennes) Huxley, Mem. Geol. Surv. x. pp. 30 & 32, fig. (1861).

? *Clarias ngamensis* Castelnau, Poiss. Afr. Austr. p. 63 (1861).

Clarias orontis Günther, Cat. Fish. v. p. 15; Sauvage, N. Arch. Mus. (2) vii. 1884, p. 18, pl. 1. fig. 2.

Clarias macracanthus Günther, t. c. pp. 16 & 429, and Petherick's Trav. ii. p. 219; Lortet, Arch. Mus. Lyon, iii. 1883, p. 151, pl. xvii.; Tristram, Faun. Palest. p. 169, pl. xix. fig. 1 (1884).

Clarias xenodon Günther, Cat. Fish. v. p. 16.

Clarias longiceps Boulenger, Ann. Mus. Congo, Zool. i. 1899, p. 103, pl. xli. fig. 1, and Poiss. Bass. Congo, p. 256 (1901).

Depth of body 5 to 9 times in total length, length of head 3 to $3\frac{1}{2}$ times. Head $1\frac{1}{2}$ to $1\frac{2}{3}$ times as long as broad, its upper surface coarsely granulate in the adult; occipital process angular or rounded; frontal fontanelle sole-shaped or knife-shaped, $2\frac{1}{2}$ to 4 times as long as broad, $3\frac{1}{2}$ to 6 times in length of head; occipital fontanelle small, in advance of occipital process; eye 2 (young) to $4\frac{1}{3}$ times in length of snout, 4 to 7 times in interorbital width; width of mouth equal to or a little less than interorbital width; band of præmaxillary teeth 4 (young) to 6 times as long as broad; vomerine teeth granular, forming a crescentic band with or without a posterior median process, its greatest width, in the middle, $1\frac{1}{2}$ to $2\frac{1}{2}$ times that of the præmaxillary band; anterior mandibular teeth pointed, posterior granular; nasal barbel $\frac{1}{3}$ to $\frac{2}{3}$ length of head (up to $\frac{4}{5}$ in the very young); maxillary barbel usually a little shorter than head, sometimes a little longer (up to once and a half in the very young), reaching extremity of pectoral spine or a little beyond extremity of pectoral fin; outer mandibular barbel once and $\frac{1}{5}$ to once and $\frac{2}{3}$ as long as inner, which measures $\frac{2}{5}$ to $\frac{3}{5}$ length of head. Gill-rakers long and closely set, 35 (very young) to 135 on anterior arch. Clavicles striated or rugose with granulations, more or less distinct under the thin skin. Dorsal 62 to 82, its distance from the occipital process $\frac{1}{7}$ to $\frac{1}{4}$ length of head, its distance from caudal not greater than diameter of eye. Anal 50 to 65, narrowly separated from caudal. Pectoral $\frac{2}{5}$ to $\frac{1}{2}$ length of head, the spine serrated on the outer side and $\frac{2}{5}$ (young) to $\frac{3}{4}$ the length of the fin. Ventral equally distant from end of snout and root of caudal, or a little nearer the former. Caudal about half length of head.

Greyish olive or olive-brown to blackish above, uniform or marbled with lighter, white or greyish beneath; vertical fins dark, often with a yellowish edge; usually a more or less distinct dark band on each side of the lower surface of the head. Young specimens often with a dark bar, edged with yellowish in front and behind, across the caudal fin. Black spots sometimes present on the caudal fin.

Total length 1170 millim.

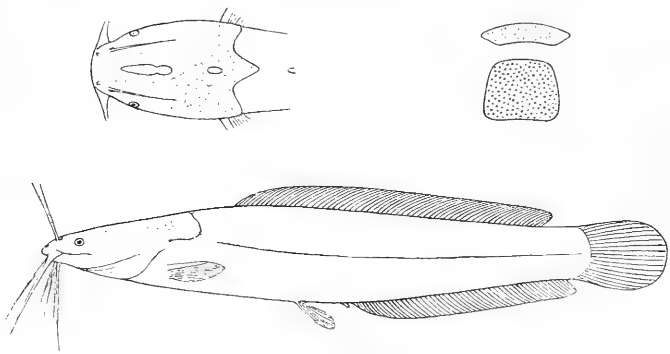
Syria, Nile, Senegal, Niger, Congo.

8. Clarias mellandi.

Boulenger, Ann. & Mag. N. H. (7) xvi. 1905, p. 644.

Depth of body $5\frac{1}{2}$ times in total length, length of head $3\frac{1}{4}$ times. Head once and $\frac{2}{3}$ as long as broad, feebly granulate above; occipital process angular; frontal fontanelle knife-shaped, $\frac{1}{3}$ length of head; occipital fontanelle very small, in advance of occipital process; eye $3\frac{1}{2}$ times in length of snout, $5\frac{1}{2}$ times in interorbital width, which exceeds width of mouth and equals $\frac{1}{3}$ length of head; band of præmaxillary teeth 4 times as long as broad; vomerine

Text-fig. 251.



Clarias mellandi.

teeth granular, forming a large semielliptic patch, squarely truncate behind, its longitudinal diameter 3 times that of the band of præmaxillary teeth; nasal barbel $\frac{2}{5}$ length of head; maxillary barbel $\frac{2}{3}$ length of head, reaching gill-opening; outer mandibular barbel $\frac{3}{5}$ length of head. Gill-rakers long, about 35 on anterior arch. Clavicles striated, distinct under the thin skin. Dorsal 65, its distance from occipital process $\frac{1}{6}$ length of head, its distance from caudal fin $\frac{1}{4}$ length of head. Anal 55, very narrowly separated from caudal. Pectoral $\frac{2}{5}$ length of head, its spine serrated on the outer border and $\frac{3}{4}$ the length of the fin. Ventral slightly nearer end of snout than caudal. Caudal $\frac{1}{2}$ length of head. Olive-brown above, marbled with darker, whitish beneath; a dark streak on each side of the throat.

Total length 345 millim.

Lake Bangwelu.

Young specimens (85–145 millim. long) recently obtained in Angola, in shallow swamps at Dongwenna, Mossamedes, by Dr. Ansorge, appear to me to be referable to this species. In the smallest, the vomerine band of teeth is crescentic, and only a little broader than the præmaxillary, whilst in the largest it forms almost a half-disk. 16–20 gill-rakers on anterior arch. Dorsal 70. Anal 60. Distance between dorsal and caudal $\frac{1}{4}$ to $\frac{1}{3}$ length of head.

9. Clarias tsanensis.

Boulenger, Ann. & Mag. N. H. (7) x. 1902, p. 438, and Fish. Nile, p. 292, pl. li. fig. 2 (1907).

Depth of body $6\frac{1}{2}$ to $7\frac{1}{2}$ times in total length, length of head

$3\frac{1}{3}$ to $3\frac{4}{5}$ times. Head $1\frac{1}{2}$ to $1\frac{2}{3}$ times as long as broad, perfectly smooth above; vertex very strongly flattened, almost concave in the adult; occipital process angular; frontal fontanelle knife-shaped, 3 to 4 times as long as broad, 4 to 5 times in length of head; occipital fontanelle indistinct; eye $2\frac{1}{2}$ (young) to 4 times in length of snout, 4 to $6\frac{2}{3}$ times in interorbital width; width of mouth nearly equal to interorbital width; band of præmaxillary teeth 4 to $5\frac{1}{2}$ times as long as broad; vomerine teeth granular, forming a crescentic band which is as broad as the præmaxillary band; nasal barbel $\frac{1}{3}$ to $\frac{1}{2}$ length of head ($\frac{3}{4}$ in the very young); maxillary barbel $\frac{3}{4}$ to once length of head (longer in the very young), reaching base or extremity of pectoral spine; outer mandibular barbels $\frac{1}{2}$ to $\frac{4}{5}$ length of head (as long as head in the very young). Gill-rakers long and closely set, 45 (young) to 70 on anterior arch. Dorsal 78 to 85, its distance from the occipital process $\frac{1}{5}$ to $\frac{1}{4}$ length of head, its distance from caudal fin equal to or a little less than diameter of eye. Anal 60 to 70, touching root of caudal. Pectoral not quite half length of head, the spine very slightly serrated on the outer border, $\frac{3}{5}$ (young) to $\frac{2}{3}$ the length of the fin. Ventral equally distant from end of snout and from caudal, or a little nearer the former. Caudal nearly $\frac{1}{2}$ length of the head. Dark olive-brown above, greyish beneath.

Total length 430 millim.

Lake Tsana, Abyssinia.

10. Clarias capensis.

Cuvier & Valenciennes, Hist. Poiss. xv. p. 377 (1840); Boulenger, Poiss. Bass. Congo, p. 255 (1901).

Depth of body $6\frac{2}{3}$ to $7\frac{1}{3}$ times in the total length, length of head 4 times. Head once and $\frac{1}{2}$ as long as broad, its upper surface coarsely granulate; occipital process angular; frontal fontanelle $3\frac{1}{2}$ to nearly 4 times as long as broad, $\frac{1}{4}$ to $\frac{1}{3}$ length of head; occipital fontanelle very small, well in advance of occipital process; eye very small, its diameter 3–4 times in length of snout, 5–7 times in interorbital width, which equals width of mouth and $\frac{2}{5}$ length of head; band of præmaxillary teeth 6 times as long as broad; band of vomerine teeth a little narrower than the præmaxillary band, rather widely interrupted in the middle, composed of small, partly pointed, partly granular teeth; nasal barbel $\frac{1}{3}$ to nearly $\frac{1}{2}$ length of head; maxillary barbel as long as head, reaching middle of pectoral spine; outer mandibular barbel $\frac{3}{4}$ length of head, inner about $\frac{1}{2}$. Gill-rakers on first arch long and closely set, 55 in number. Clavicles hidden under the skin. Dorsal fin with 63–72 rays, its distance from occipital process $\frac{2}{7}$ to $\frac{1}{3}$ length of head, its distance from caudal 1–4 times diameter of eye. Anal fin with 50–52 rays, narrowly separated from caudal. Pectoral fin $\frac{1}{2}$ length of head, the spine feebly serrated on the outer border, $\frac{2}{3}$–$\frac{4}{5}$ the length of the fin. Ventral fin once and $\frac{1}{4}$ as distant from root of caudal as from end of snout. Caudal fin $\frac{1}{2}$ length of head. Dark olive-brown above, whitish beneath.

Total length 550 millim.

Natal.

In addition to a specimen from Pietermaritzburg, I have examined the type in the Paris Museum, a stuffed specimen stated to be from the Cape of Good Hope.

11. Clarias platycephalus.

Boulenger, Ann. Mus. Congo, Zool. ii. 1902, p. 35, pl. x. fig. 1.

Depth of body 6 to $6\frac{1}{2}$ times in total length, length of head $3\frac{1}{2}$ to 4 times. Head once and $\frac{1}{4}$ as long as broad, feebly granulate above; occipital process obtusely pointed; frontal fontanelle sole-shaped, $\frac{1}{5}$ to $\frac{1}{4}$ length of head; occipital fontanelle smaller, in advance of occipital process; eye very small, 4 times in length of snout, $7\frac{1}{2}$ to 8 times in interorbital width, which equals width of mouth and $\frac{1}{2}$ length of head; band of præmaxillary teeth 5 times as long as broad; vomerine teeth conical, forming a crescentic band which is as broad as the præmaxillary band; nasal barbel $\frac{3}{5}$ to $\frac{3}{4}$ length of head; maxillary barbel once and $\frac{1}{3}$ as long as head, extending beyond extremity of pectoral fin; outer mandibular barbel as long as head, inner $\frac{2}{3}$ to $\frac{3}{4}$. Gill-rakers few and wide apart, 12 on anterior arch. Clavicles hidden under the skin. Dorsal 65–70, its distance from occipital process $\frac{1}{4}$ length of head, its distance from caudal greater than diameter of eye. Anal 56–62, narrowly separated from caudal. Pectoral $\frac{1}{2}$ length of head, the spine smooth and $\frac{5}{7}$ the length of the fin. Ventral a little nearer end of snout than root of caudal. Caudal $\frac{1}{2}$ length of head. Dark brown above, brownish white beneath; anal with a light edge; caudal with dark bars.

Total length 340 millim.

Upper Congo; Kribi River, South Cameroon.

12. Clarias carsonii.

Boulenger, Ann. & Mag. N. H. (7) xii. 1903, p. 362, and Fish. Nile, p. 294, pl. liii. fig. 1 (1907).

Depth of body $6\frac{1}{2}$ to $9\frac{1}{2}$ times in total length, length of head $4\frac{1}{6}$ to 5 times. Head $1\frac{1}{5}$ to $1\frac{1}{3}$ times as long as broad, smooth; occipital process angular, not longer than broad; frontal fontanelle sole-shaped or knife-shaped, $2\frac{1}{2}$ to 3 times as long as broad, 4 or 5 times in length of head; occipital fontanelle small, in advance of or encroaching a little on occipital process; eye 3 to 5 times in length of snout, 6 to $8\frac{2}{3}$ times in interorbital width; width of mouth a little less than interorbital width; band of præmaxillary teeth $3\frac{1}{2}$ to 5 times as long as broad; vomerine teeth conical, some very obtusely, forming a crescentic band which is about as broad as the præmaxillary band; nasal barbel $\frac{2}{5}$ to $\frac{3}{5}$ length of head; maxillary barbel $\frac{3}{5}$ to $\frac{3}{4}$ length of head, not reaching or reaching gill-opening; outer mandibular barbel $1\frac{1}{3}$ to $1\frac{1}{2}$ times length of inner, which measures $\frac{1}{2}$ to $\frac{2}{3}$ length of head. Gill-rakers few and wide apart, 10 or 11 on anterior arch. Clavicles hidden under the skin. Dorsal 65 to 78, its distance from occipital process $\frac{2}{5}$ to $\frac{3}{5}$ length of the head, its distance from caudal equal to one or two diameters of eye. Anal 57 to 64, nearly touching caudal. Pectoral about $\frac{1}{2}$ length of head, the spine very indistinctly serrated and measuring about $\frac{2}{3}$ the length of the fin. Ventral $1\frac{1}{3}$ to $1\frac{2}{3}$ times as distant from caudal as from end of snout. Caudal $\frac{1}{2}$ as long as head. Dark brown above, lighter brown beneath.

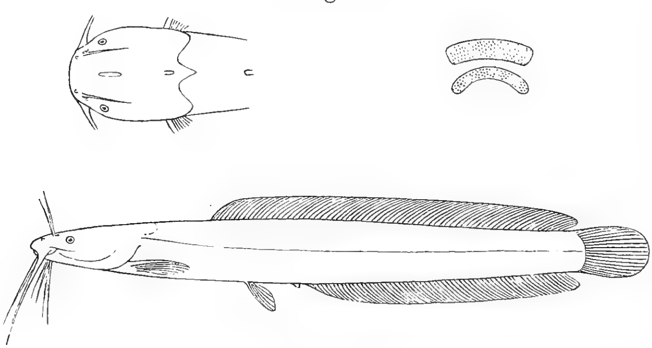
Total length 285 millim.

Lake Victoria to Lake Nyassa.

13. Clarias poensis, sp. n.

Depth of body $8\frac{1}{3}$ times in total length, length of head $4\frac{1}{3}$ times. Head once and $\frac{1}{3}$ as long as broad, smooth; occipital process acutely pointed, as long as broad; frontal and occipital fontanelles very small, the latter in advance of occipital process; eye very small, 3 times in length of snout, 7 times in interorbital width, which equals width of mouth and $\frac{1}{2}$ length of head; band of præmaxillary teeth 4 times as long as broad; vomerine teeth

Text-fig. 252.



Clarias poensis.

conical, forming a curved band which is narrower than the præmaxillary band; nasal barbel about $\frac{2}{5}$ length of head, maxillary $\frac{5}{6}$ length of head and reaching a little beyond base of pectoral; outer mandibular $\frac{2}{3}$, inner mandibular $\frac{2}{5}$ length of head. Gill-rakers few, 13 on anterior arch. Clavicles concealed under the skin. Dorsal 76, its distance from occipital process $\frac{2}{5}$ length of head, its distance from caudal fin a little greater than diameter of eye. Anal 60, narrowly separated from caudal. Pectoral $\frac{1}{2}$ length of head, the spine very feebly serrated on both sides and about $\frac{2}{3}$ the length of the fin. Ventral once and $\frac{1}{2}$ as distant from base of caudal as from end of snout. Caudal $\frac{1}{2}$ length of head. Dark brown, lighter beneath.

Total length 285 millim.

Fernando Po. A single specimen, from Mr. E. Seimund's collection.

14. Clarias submarginatus.

Peters, Sitzb. Ges. Naturf. Fr. Berl. 1882, p. 74.

Depth of body 6 to $6\frac{1}{2}$ times in total length, length of head 4 to 5 times. Head once and $\frac{1}{3}$ as long as broad, smooth; occipital process pointed; frontal fontanelle knife-shaped, $2\frac{1}{2}$ to 3 times as long as broad; occipital fontanelle smaller, slightly encroaching on the occipital process; eye very small, 3 times in length of snout, 7 times in interorbital width, which equals width of mouth and $\frac{1}{2}$ length of head; band of præmaxillary teeth $4\frac{1}{2}$ or 5 times as long as broad; vomerine teeth conical, forming a curved band which is as broad as the præmaxillary band; nasal barbel about $\frac{2}{3}$ or $\frac{3}{4}$ length of head, maxillary once and $\frac{1}{6}$ to once and $\frac{1}{4}$, outer mandibular once, inner mandibular $\frac{3}{5}$. Gill-rakers very few, 10 on anterior arch. Clavicles concealed under the skin. Dorsal 75–84, its distance from occipital process $\frac{2}{5}$ length of head, its distance from caudal equal to or a little greater than diameter of eye. Anal 60–70, also separated from the caudal. Pectoral $\frac{1}{2}$ length of head, the spine very feebly serrated on outer side and about $\frac{2}{3}$ the length of the fin. Ventral once and $\frac{1}{3}$ as distant from base of caudal as from end of snout. Caudal $\frac{1}{2}$ length of head. Dark brown, lighter beneath; a dark, light-edged curved band on the caudal.

Total length 210 millim.

Two specimens, from the Ja River, in S. Cameroon, were obtained by Mr. Bates.

The type specimens (young) preserved in the Berlin Museum, and on which I have notes furnished me by the late Prof. Hilgendorf, are from the 'Tooxlong River' in West Africa, a river which I have not been able to trace but which is probably somewhere in the Cameroon or Gaboon district.

15. Clarias liocephalus.

Clarias liocephalus, Bouleng. Tr. Zool. Soc. xv. 1898, p. 24, pl. vii. fig. 2, and Poiss. Bass. Congo, p. 257 (1901).

Depth of body $5\frac{1}{2}$ to 7 times in total length, length of head $4\frac{1}{2}$ or 5 times. Head $1\frac{1}{4}$–$1\frac{1}{3}$ times as long as broad, smooth; occipital process angular; fontanelles feebly distinct, occipital in advance of occipital process; eye small, 3 times in length of snout, 5 to 6 times in interorbital width; width of mouth equal to interorbital width, $\frac{1}{2}$ length of head; vomerine teeth conical, forming a crescentic band which is about as broad as the præmaxillary band; nasal barbel $\frac{2}{3}$ to $\frac{3}{4}$ length of head; maxillary barbel as long as head or a little longer, extending to middle or extremity of pectoral; outer mandibular barbel about $1\frac{1}{4}$ length of inner, which measures $\frac{3}{5}$ to $\frac{2}{3}$ length of head. 13 to 15 gill-rakers on first arch. Clavicles not exposed. Dorsal 70–72, its distance from occipital process $\frac{3}{5}$ or $\frac{2}{3}$ length of head, its distance from caudal greater than diameter of eye. Anal 50–58, not reaching caudal. Pectoral about $\frac{1}{2}$ length of head, the spine feeble, not serrated, about $\frac{1}{2}$ the length of the fin. Ventrals much nearer end of snout than caudal. Caudal $\frac{1}{2}$ length of head. Uniform blackish brown.

Total length 140 millim.

Lake Tanganyika; Upper Ubanghi.

16. Clarias breviceps.

Boulenger, Ann. Mus. Congo, Zool. i. 1900, p. 135, pl. xlviii. fig. 6, and Poiss. Bass. Congo, p. 258, pl. xiii. fig. 1 (1901).

Depth of body 6 to 8 times in total length, length of head $4\frac{1}{2}$ to 5 times. Head $1\frac{1}{6}$ as long as broad, smooth; occipital process angular; fontanelles small, the frontal sole-shaped and nearly $\frac{1}{5}$ length of head, the occipital oval and partly on the occipital process; eye very small, its diameter 3 times in length of snout, 6 times in interorbital width; width of mouth equal to interorbital width, $\frac{1}{2}$ length of head; vomerine teeth conical, forming a crescentic band which is as broad as the præmaxillary band; nasal barbel $\frac{3}{5}$ length of head; maxillary barbel as long as or a little longer than head, extending to extremity of pectoral; outer mandibular barbel about $1\frac{1}{2}$ length of inner, which measures $\frac{3}{5}$ length of head. 20 gill-rakers on first arch. Clavicles not exposed. Dorsal 58–60, its distance from the occipital process $\frac{1}{2}$ length of head, its distance from the caudal fin greater than the diameter of the eye. Anal 40–42, not reaching caudal. Pectoral about $\frac{1}{2}$ length of head, the spine not serrated, about $\frac{2}{3}$ the length of the fin. Ventrals much nearer end of snout than caudal. Caudal $\frac{1}{2}$ length of head. Uniform blackish brown above, brownish white beneath.

Total length 190 millim.

Marshes of Siala-Ntoto, Mayombe.

17. Clarias walkeri.

Clarias walkeri Günther, Ann. & Mag. N. H. (6) xvii. 1896, p. 274, pl. xiv. fig. B.

Depth of body 6 to 8 times in total length, length of head 4 to $4\frac{1}{2}$ times. Head $1\frac{1}{4}$ to $1\frac{1}{3}$ as long as broad, smooth above, or very finely granulate behind; occipital process angular; frontal fontanelle small, sole-shaped; occipital fontanelle smaller, in advance of or slightly encroaching upon occipital process; eye very small, its diameter 3 to 4 times in length of snout, 6 to 8 times in interorbital width, which nearly equals width of mouth and is contained twice in length of head; band of præmaxillary teeth 4 to 5 times as long as broad; vomerine teeth conical, forming a crescentic band which, in the middle, is about as broad as the præmaxillary band; nasal barbel $\frac{2}{3}$ to $\frac{3}{4}$ length of head; maxillary barbel $1\frac{1}{2}$ to 2 times as long as head, reaching extremity of pectoral or base of ventral; inner mandibular barbel a little shorter than nasal, $\frac{1}{2}$ to $\frac{3}{5}$ length of outer. Gill-rakers on first arch widely set, 12 to 15 in number. Clavicles concealed under the skin. Dorsal 70–80, its distance from occipital process $\frac{1}{3}$ to $\frac{1}{2}$ length of head, separated from caudal by an interspace at least as great as diameter of eye. Anal 52–60, narrowly separated from caudal. Pectoral $\frac{1}{2}$ to $\frac{3}{5}$ length of head, the spine feebly serrated on both sides, $\frac{3}{5}$ the length of the fin. Ventrals $1\frac{1}{3}$ to $1\frac{2}{5}$ times as distant from base of caudal as from end of snout. Caudal about $\frac{1}{2}$ to $\frac{3}{5}$ length of head. Dark brown above, whitish beneath; dorsal and anal with a lighter edge.

Total length 290 millim.

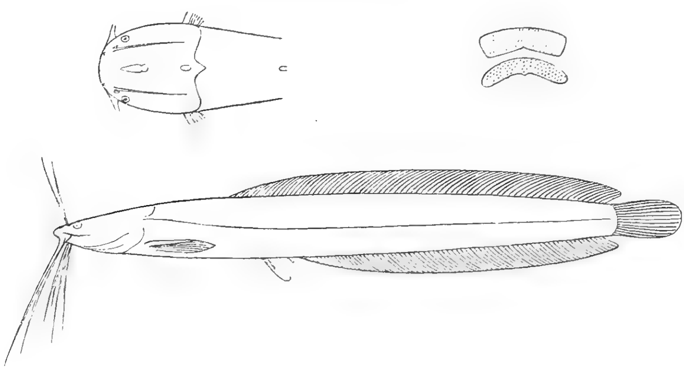
South Cameroon to Ogowe.

18. Clarias longior.

Boulenger, Ann. & Mag. N. H. (7) xx. 1907, p. 51.

Depth of body 8 to 9 times in total length, length of head 5 to $5\frac{1}{2}$ times. Head extremely depressed, once and $\frac{1}{4}$ as long as broad, smooth; occipital process very short, pointed; frontal fontanelle knife-shaped, about 3 times as long as broad; occipital fontanelle smaller, in advance of occipital process; eye very small, $2\frac{1}{2}$ times in length of snout, 5 or $5\frac{1}{2}$ times in interorbital width, which equals width of mouth and $\frac{1}{2}$ length of head; band of

Text-fig. 253.



Clarias longior.

præmaxillary teeth 4 times as long as broad; vomerine teeth granular, forming a curved band which is as broad as the præmaxillary band; nasal barbel $\frac{2}{3}$ to $\frac{3}{4}$ length of head, maxillary $1\frac{1}{4}$ to $\frac{1}{2}$ times, outer mandibular once, inner mandibular $\frac{3}{5}$ to $\frac{2}{3}$. Gill-rakers very few, 12 on anterior arch. Clavicles concealed under the skin. Dorsal 80, its distance from occipital process $\frac{3}{5}$ to $\frac{2}{3}$ length of head, its distance from caudal equal to diameter of eye. Anal 70–73, nearly reaching caudal. Pectoral $\frac{3}{5}$ to $\frac{2}{3}$ length of head, the spine smooth and about $\frac{2}{3}$ the length of the fin. Ventral $1\frac{2}{3}$ to $1\frac{3}{4}$ times as distant from base of caudal and from end of snout. Caudal $\frac{2}{3}$ length of head. Dark brown above, whitish beneath.

Total length 225 millim.

Kribi River and Lobi River, South Cameroon.

19. Clarias angolensis.

Steindachner, Verh. zool.-bot. Ges. Wien, xvi. 1866, p. 766, pl. xiii. figs. 4 & 7; Boulenger, Poiss. Bass. Congo, p. 259 (1901).

Clarias gabonensis Günther, Ann. & Mag. N. H. (3) xx. 1867, p. 111, and (6) xvii. 1896, p. 274.

Clarias dolloi Boulenger, Ann. & Mag. N. H. (6) xvii. 1896, p. 311.

Depth of body 6 to 7 times in total length, length of head $3\frac{1}{2}$ to $4\frac{1}{5}$ times. Head $1\frac{1}{2}$ as long as broad, smooth or finely striated and finely granulate; occipital process angular or rounded, as long as broad or broader than long; frontal fontanelle oval or sole-shaped, twice as long as broad; occipital fontanelle smaller, extending on the occipital process in the young; eye small, its diameter 3 to 4 times in length of snout, $4\frac{1}{2}$ to 6 times in interorbital width, which, like the width of the mouth, is about $\frac{2}{5}$ length of head; band of præmaxillary teeth nearly 4 times as long as broad; vomerine teeth conical or subgranular, forming a crescentic band which, in the middle, is about as broad as the præmaxillary band and may bear a short posterior process; nasal barbel nearly as long as head; maxillary barbel $1\frac{1}{2}$ to $1\frac{2}{3}$ times length of head, reaching beyond pectoral, sometimes as far as ventral; inner mandibular barbel a little shorter than nasal, $\frac{3}{5}$ or $\frac{2}{3}$ length of outer. Gill-rakers on first arch fine, not very closely set, 25 to 30 in number. Clavicles exposed, striated or feebly granulated. Dorsal 70–82, its distance from occipital process $\frac{1}{4}$ or $\frac{1}{5}$ length of head, very narrowly separated from caudal. Anal 55–63, narrowly separated from caudal. Pectoral $\frac{1}{2}$ length of head, the spine serrated on both sides, $\frac{3}{4}$ to $\frac{4}{5}$ the length of the fin. Ventrals nearer end of snout than caudal. Caudal about $\frac{1}{2}$ length of head. Uniform dark brown or black, with more or less distinct light dots.

Total length 350 millim.

Cameroon, Gaboon, Congo, Angola.

20. Clarias bythipogon.

Clarias buthupogon Sauvage, Bull. Soc. Philom. (7) iii. 1878, p. 96; Günth. Ann. & Mag. N. H. (6) xvii. 1896, p. 275; Boulenger, Poiss. Bass. Congo, p. 261 (1901).

Clarias gabonensis (non Günth.) Sauvage, N. Arch. Mus. (2) iii. 1880, p. 39, pl. i. fig. 2.

Clarias camerunensis Lönnberg, Overs. Vet.-Ak. Förh. Stockh. 1895, p. 192.

Depth of body 6 to 7 times in total length, length of head 4 to $4\frac{1}{4}$ times. Head $1\frac{1}{3}$ to $1\frac{1}{2}$ times as long as broad, smooth above, or very finely granulate behind; occipital process angular; frontal fontanelle small, sole-shaped; occipital fontanelle smaller, partly on the occipital process; eye small, its diameter $2\frac{1}{2}$ times in length of snout, 4 or 5 times in interorbital width, which nearly equals width of mouth and is contained twice in length of head; band of præmaxillary teeth 4 to 5 times as long as broad; vomerine teeth conical, forming a crescentic band which is as broad as or narrower than the præmaxillary band; nasal barbel a little longer than head; maxillary barbel 2 to $2\frac{1}{2}$ times as long as head, reaching beyond base of ventral; inner mandibular barbel at least as long as head, about $\frac{2}{3}$ length of outer. 17–22 gill-rakers on first arch. Clavicles concealed under the skin. Dorsal 78–87, its distance from occipital process $\frac{2}{7}$ or $\frac{1}{3}$ length of head, almost in contact with caudal. Anal 55–67, almost in contact with caudal. Pectoral $\frac{1}{2}$ to $\frac{3}{5}$ length of head, the spine serrated on both sides, $\frac{2}{3}$ to $\frac{3}{4}$ the length of the fin. Ventrals much nearer end of snout than caudal. Caudal $\frac{1}{2}$ or nearly $\frac{2}{3}$ length of head. Olive-brown above, whitish beneath; anal fin with a dark edge.

Total length 230 millim.

Old Calabar to Congo.

21. Clarias alluaudi.

Boulenger, Ann. & Mag. N. H. (7) xvii. 1906, p. 437, and Fish. Nile, p. 296, pl. liii. fig. 2 (1907).

Clarias macrophthalmus (non Pfeffer) Pellegrin, Mém. Soc. Zool. France, xvii. 1905, p. 176.

Depth of body $5\frac{2}{3}$ to $6\frac{1}{2}$ times in total length, length of head 4 to $4\frac{1}{2}$ times. Head $1\frac{1}{3}$ to $1\frac{1}{2}$ times as long as broad, smooth above; occipital process acutely pointed, longer than broad; frontal fontanelle twice as long as broad, about 4 times in length of head; occipital fontanelle small, extending on occipital process; eye 2 or $2\frac{1}{2}$ times in length of snout, 4 or 5 times in interorbital width; width of mouth a little less than interorbital width; band of præmaxillary teeth about 4 times as long as broad; vomerine teeth conical, forming a crescentic band which is longer and a little broader than the band of præmaxillary teeth; nasal barbel as long as or a little longer than head; maxillary barbel $1\frac{1}{2}$ to $1\frac{2}{3}$ times length of head, reaching ventral or between pectoral and ventral; outer mandibular barbel $1\frac{1}{3}$ to $1\frac{1}{2}$ times as long as inner and about $1\frac{1}{3}$ length of head. Gill-rakers moderate, 14 or 15 on anterior arch. Clavicles hidden under the skin. Dorsal 65 to 78, its distance from occipital process about $\frac{1}{4}$ length of head, extending to root of caudal. Anal 55 to 62, extending to root of caudal. Pectoral $\frac{1}{2}$ length of head, the spine serrated on both sides and about $\frac{2}{3}$ the length of the fin. Ventral $1\frac{1}{2}$ times as distant from root of caudal as from end of snout. Caudal about $\frac{1}{2}$ as long as head. Blackish brown above, lighter brown beneath.

Total length 230 millim.

Lake Victoria.

22. Clarias werneri.

Boulenger, Ann. & Mag. N. H. (7) xvii. 1906, p. 569; Werner, Sitzb. Ak. Wien, cxv. i. 1906, p. 1135, pl. iv.; Boulenger, Fish. Nile, p. 297, pl. liii. fig. 3 (1907).

Depth of body $6\frac{1}{2}$ to 8 times in total length, length of head $4\frac{1}{2}$ to 5 times. Head about once and $\frac{1}{2}$ as long as broad, smooth or very feebly granulate above; occipital process angular, not longer than broad; frontal fontanelle more or less distinctly sole-shaped, $1\frac{1}{2}$ to 2 times as long as broad, its length 4 to 5 times in that of the head; occipital fontanelle as large or a little smaller, oval or elliptic, partly on occipital process; eye 2 to 3 times in length of snout, 5 to 6 times in interorbital width; width of mouth a little less than interorbital width; band of præmaxillary teeth 3 to 4 times as long as broad; vomerine teeth granular, forming a crescentic band which is as broad as or a little narrower than the præmaxillary band; nasal barbel nearly once to once and $\frac{1}{2}$ length of head; maxillary barbel $1\frac{1}{5}$ to 2 times length of head, reaching extremity of pectoral or beyond; outer mandibular barbel about once and $\frac{1}{2}$ as long as inner and equal to or longer than head. Gill-rakers moderate, 16 to 18 on anterior arch. Clavicles hidden under the skin. Dorsal 82 to 91, its distance from occipital process nearly $\frac{1}{3}$ length of head, in contact with or very narrowly separated from caudal. Anal 68 to 72, in contact with or very narrowly separated from caudal. Pectoral nearly $\frac{1}{2}$ length of head, the spine very feebly serrated on the outer border and about $\frac{2}{3}$ the length of the fin. Ventral $1\frac{3}{5}$ to $1\frac{3}{4}$ times as distant from root of caudal as from end of snout. Caudal about $\frac{1}{2}$ as long as head. Blackish brown above, lighter beneath.

Total length 230 millim.

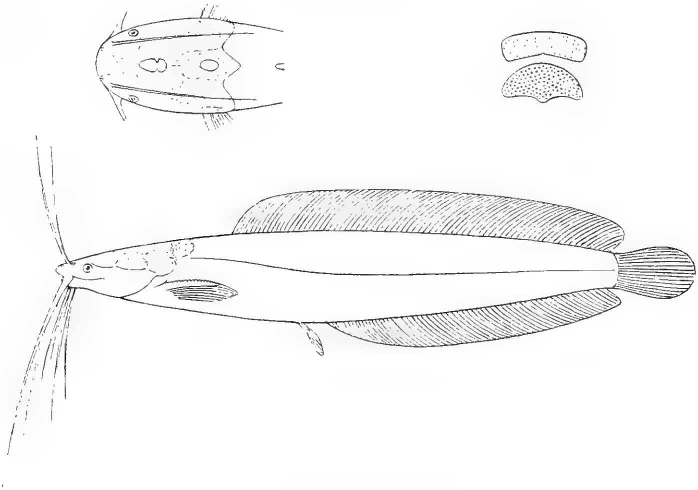
Uganda.

23. Clarias macromystax.

Günther, Cat. Fish. v. p. 17 (1864).

Depth of body $6\frac{1}{3}$ times in total length, length of head 4 times. Head $1\frac{1}{2}$ as long as broad, finely granulate above; occipital process angular; frontal fontanelle oval, not quite twice as long as broad; occipital fontanelle smaller, in advance of occipital process; eye small, its diameter 3 times in length of snout, $5\frac{1}{2}$ times in interorbital width, which equals width of mouth and $\frac{2}{5}$ length of head; band of præmaxillary teeth only 3 times as long as broad; vomerine teeth mostly granular, forming a large fan-shaped patch the longitudinal diameter of which exceeds the width of the præmaxillary band; nasal barbel as long as head; maxillary barbel $1\frac{1}{2}$ length of head, reaching nearly to base of ventral; inner mandibular barbel nearly as long as nasal, $\frac{2}{3}$ length of outer. Gill-rakers on first arch not closely set, 16 in number. Clavicles exposed, striated. Dorsal 80, its distance from occipital process $\frac{1}{4}$ length of head, very narrowly separated from caudal. Anal 63,

Text-fig. 254.



Clarias macromystax.

very narrowly separated from caudal. Pectoral $\frac{1}{2}$ length of head, the spine strongly serrated on both sides, $\frac{3}{4}$ the length of the fin. Ventrals much nearer end of snout than caudal. Caudal $\frac{1}{2}$ length of head. Dark brown.

Total length 205 millim.

Gambia.

24. Clarias dumerilii.

Steindachner, Verh. zool.-bot. Ges. Wien, xvi. 1866, p. 766, pl. xiii. fig. 8, & pl. xiv. fig. 5.

Depth of body 6 to $7\frac{1}{2}$ times in total length, length of head 4 to $4\frac{1}{2}$ times. Head $1\frac{1}{4}$ to $1\frac{1}{3}$ times as long as broad, smooth above; occipital process angular; frontal fontanelle sole-shaped, about twice as long as broad; occipital fontanelle smaller, usually extending on the occipital process; eye very small, its diameter 3 times in length of snout, 6 or 7 times in interorbital width, which, like the width of the mouth, measures $\frac{1}{2}$ length of head; band of præmaxillary teeth 4 times as long as broad; vomerine teeth conical or subgranular, forming a crescentic band which, in the middle, is a little narrower than the præmaxillary band; nasal barbel $\frac{2}{3}$ to $\frac{3}{4}$ length of head; maxillary barbel as long as or a little longer than head, reaching middle or end of pectoral fin;

inner mandibular barbel $\frac{1}{2}$ to $\frac{2}{3}$ length of head, about $\frac{2}{3}$ length of outer. Gill-rakers on first arch not closely set, 12 to 15 in number. Clavicles concealed under the skin. Dorsal 66–72, its distance from occipital process about $\frac{1}{2}$ length of head, narrowly separated from caudal. Anal 49–55. Pectoral $\frac{1}{2}$ to $\frac{3}{5}$ length of head, the spine serrated on both sides, about $\frac{1}{2}$ the length of the fin. Ventrals much nearer end of snout than caudal. Caudal about $\frac{3}{5}$ length of head. Uniform dark brown.

Total length 155 millim.

Angola.

25. Clarias liberiensis.

Steindachner, Notes Leyd. Mus. xvi. 1894, p. 54.

Clarias bulumæ Steindachner, t. c. p. 55.

Depth of body 5 to $6\frac{1}{2}$ times in total length, length of head $3\frac{1}{2}$ to $4\frac{1}{2}$ times. Head $1\frac{1}{4}$ to $1\frac{1}{3}$ times as long as broad, smooth or very finely granulate above; occipital process angular; frontal fontanelle small, sole-shaped; occipital fontanelle smaller, just in advance of occipital process; eye very small, its diameter 3 times in length of snout, 7 or 8 times in interorbital width, which equals width of mouth and is contained twice in length of head; band of præmaxillary teeth 4 times as long as broad; vomerine teeth conical or subgranular, forming a crescentic band which is as broad as the præmaxillary band; nasal barbel $\frac{3}{4}$ to $\frac{4}{5}$ length of head; maxillary barbel a little longer (up to $1\frac{2}{5}$) than head, reaching nearly to end of pectoral fin or a little beyond; inner mandibular barbel as long as nasal, little shorter than outer. About 20 gill-rakers on the first arch. Clavicles concealed under the skin. Dorsal 60–68, its distance from occipital process $\frac{2}{5}$ length of head, almost in contact with caudal. Anal 44–55, almost in contact with caudal. Pectoral nearly $\frac{1}{2}$ length of head, the spine feebly serrated on both sides, $\frac{2}{3}$ or $\frac{3}{4}$ the length of the fin. Ventrals much nearer end of snout than caudal. Caudal nearly $\frac{2}{3}$ length of head. Olive-brown.

Total length 220 millim.

Sierra Leone and Liberia, S. Cameroon, Benito R.

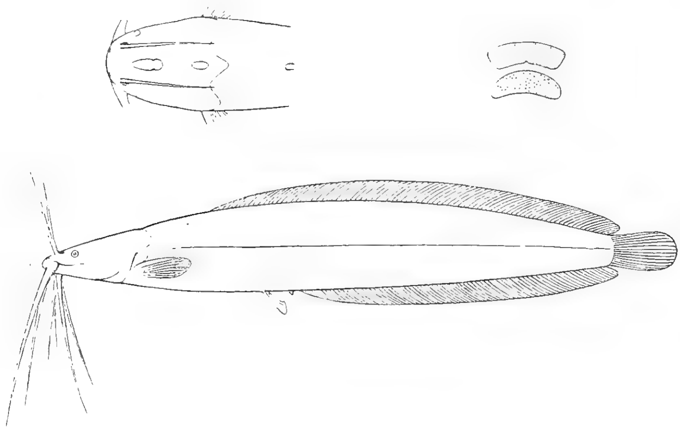
26. Clarias pachynema.

Boulenger, Ann. & Mag. N. H. (7) xii. 1903, p. 438.

Depth of body $6\frac{1}{2}$ to 7 times in total length, length of head $4\frac{2}{3}$ to 5 times. Head $1\frac{2}{5}$ to $1\frac{1}{2}$ times as long as broad, smooth; occipital process acutely pointed; frontal fontanelle sole-shaped, about twice as long as broad; occipital fontanelle smaller, in advance of occipital process; eye very small, 3 to 4 times in length of snout, 6 times in interorbital width, which equals about $\frac{2}{5}$ length of head and exceeds width of mouth; band of præmaxillary teeth $2\frac{1}{2}$ to 3 times as long as broad; vomerine teeth conical, forming a short curved band, which in the middle is as broad as the præmaxillary band; barbels thick and papillose at the base;

nasal barbel $\frac{3}{4}$ to $\frac{4}{5}$ length of head, maxillary $1\frac{1}{3}$ to $1\frac{1}{2}$ times, outer mandibular $1\frac{1}{4}$ to $1\frac{1}{3}$ times, inner mandibular $\frac{3}{4}$ to $\frac{4}{5}$. Gill-rakers few, about 15 on anterior arch. Clavicles concealed under the skin. Dorsal 92–95, its distance from occipital process $\frac{2}{5}$ to $\frac{1}{2}$ length of head. Anal 78-80. Dorsal and anal extending to

Text-fig. 255.



Clarias pachynema.

root of caudal. Pectoral $\frac{1}{2}$ length of head, its spine feebly serrated on both sides and $\frac{2}{3}$ to $\frac{3}{4}$ the length of the fin. Ventral about once and $\frac{3}{5}$ as distant from caudal as from end of snout. Caudal $\frac{1}{2}$ length of head. Dark olive-brown above, yellowish beneath.

Total length 255 millim.

Ja River, S. Cameroon.

27. Clarias læviceps.

Gill, Proc. Ac. Philad. 1862, p. 139; Sauvage, Bull. Soc. Zool. France, 1882, p. 318, pl. v. fig. 2; Boulenger, Proc. Zool. Soc. 1904, i. p. 200.

Clarias kingsleyæ Günther, Proc. Zool. Soc. 1902, ii. p. 334.

Depth of body $8\frac{1}{2}$ to 12 times in total length, length of head 5 to $5\frac{1}{2}$ times. Head $1\frac{1}{4}$ to $1\frac{1}{3}$ times as long as broad, smooth; occipital process pointed; frontal fontanelle sole-shaped, about twice as long as broad; occipital fontanelle smaller, in advance of occipital process; eye very small, 3 to 4 times in length of snout, 6 to 7 times in interorbital width, which equals $\frac{1}{2}$ length of head and a little exceeds width of mouth; band of præmaxillary teeth 4 to 5 times as long as broad; vomerine teeth conical, forming a curved band which is as broad as or a little narrower than the præmaxillary band; barbels moderately thick, nasal $\frac{1}{2}$ to $\frac{2}{3}$ length of head, maxillary $1\frac{1}{4}$ to $\frac{3}{5}$ times, outer mandibular once, inner mandibular $\frac{2}{3}$. Gill-rakers few, 15 to 20 on first arch. Clavicles concealed under the skin. Dorsal fin 79–87, its distance from occipital process $\frac{1}{2}$ to $\frac{2}{3}$ length of head. Anal fin 68–78. Dorsal and anal fins extending almost to the very root of the caudal. Pectoral fin $\frac{3}{5}$ to $\frac{2}{3}$ length of head, the spine feebly serrated on the outer side and $\frac{2}{3}$ to $\frac{3}{4}$ the length of the fin. Ventral fin $1\frac{1}{2}$ to $1\frac{2}{3}$ times as far from caudal as from end of snout. Caudal fin $\frac{1}{2}$ to $\frac{2}{3}$ length of head. Uniform dark brown above, light brown beneath, in spirit.

Total length 270 millim.

Gold Coast, Cameroon.

Type (U.S. Nat. Mus.) examined.

28. Clarias buettikoferi.

Steindachner, Notes Leyd. Mus. xvi. 1894, p. 53.

Depth of body 6 times in total length, length of head 4 times. Head nearly $1\frac{1}{3}$ as long as broad, nearly smooth above; occipital process pointed; eye very small, about 6 times in interorbital width, which is a little more than $\frac{1}{2}$ length of head; width of mouth $\frac{1}{2}$ length of head; vomerine teeth obtusely conical, forming a crescentic band which, in the middle, is as broad as the præmaxillary band; nasal barbel reaching middle of pectoral; maxillary barbel extending a little beyond end of pectoral. Dorsal 55, anal 50, the last ray completely adnate to the caudal. Pectoral a little more than $\frac{1}{2}$ length of head; spine short, serrated on the inner edge only. Dark reddish brown.

Total length 155 millim.

Liberia.

Only known to me from the description quoted above. The type specimen, I am informed by Mlle. Dr. Popta, is not to be found in the Leyden Museum, which is supposed to contain the types of the fishes discovered by Dr. Büttikofer.

29. Clarias amplexicauda.

Boulenger, Ann. Mus. Congo, Zool. ii. 1902, p. 36, pl. x. fig. 2.

Depth of body 7 times in total length, length of head 5 times. Head once and $\frac{1}{4}$ as long as broad, smooth; occipital process very short and forming a very open angle; frontal fontanelle sole-shaped, $\frac{1}{5}$ length of head; occipital fontanelle smaller, in advance of occipital process; eye $\frac{1}{2}$ length of snout, $\frac{1}{4}$ interorbital width, which is a little less than $\frac{1}{2}$ length of head and equals width of mouth; band of præmaxillary teeth 4 times as long as broad; vomerine teeth conical, forming a crescentic band which is as broad as the præmaxillary band; nasal barbel $\frac{1}{5}$ length of head *.

* The other barbels are mutilated in the single known specimen.

Gill-rakers rather long, 15 on anterior arch. Clavicles feebly striated and covered with a thin skin. Dorsal 80, its distance from occipital process $\frac{2}{5}$ length of head. Anal 65. Both dorsal and anal embracing root of caudal. Pectoral $\frac{3}{5}$ length of head, its spine serrated on both sides and measuring $\frac{2}{3}$ the length of the fin. Ventral once and $\frac{1}{2}$ as distant from caudal as from end of snout. Caudal a little more than $\frac{1}{2}$ length of head. Blackish brown above, a little lighter beneath.

Total length 155 millim.

Upper Ubanghi.

30. Clarias theodoræ.

M. Weber, Zool. Jahrb., Syst. x. 1897, p. 150.

Depth of body 6 times in total length, length of head $4\frac{1}{2}$ to $5\frac{1}{4}$ times. Head once and $\frac{2}{5}$ as long as broad, smooth; occipital process angular, broader than long; frontal fontanelle sole-shaped, twice as long as broad and about $\frac{1}{4}$ length of head; occipital fontanelle smaller, in advance of occipital process; eye very small, 3 times in length of snout, 6 times in interorbital width, which equals width of mouth and a little less than $\frac{1}{2}$ length of head; band of præmaxillary teeth 4 times as long as broad; vomerine teeth conical, forming a curved band which is as broad as the præmaxillary band; nasal barbel $\frac{4}{5}$ length of head; maxillary barbel as long as or a little longer than head, as long as outer mandibular. 14 gill-rakers on anterior arch. Clavicles feebly striated, distinct under the skin. Dorsal 80–90, its distance from occipital process $\frac{1}{3}$ length of head. Anal 67–73. Dorsal and anal embracing base of caudal. Pectoral about $\frac{1}{2}$ length of head, its spine feebly serrated on the outer side, strongly on the inner and measuring $\frac{1}{2}$ to $\frac{2}{3}$ the length of the fin. Ventral once and $\frac{1}{2}$ as distant from caudal as from end of snout. Caudal about $\frac{1}{2}$ length of head. Greenish grey to blackish.

Total length 180 millim.

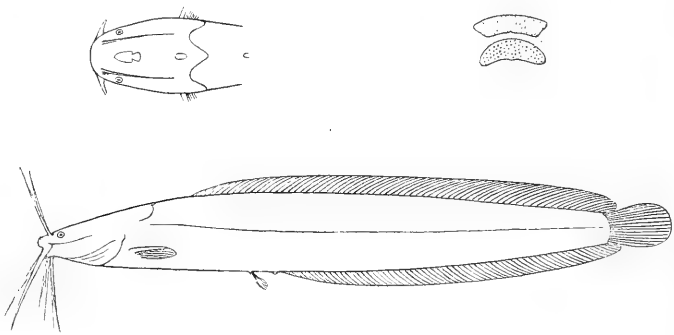
Natal.

31. Clarias fouloni.

Boulenger, Ann. & Mag. N. H. (7) xvi. 1905, p. 644.

Depth of body $6\frac{1}{2}$ times in total length, length of head 5 times. Head once and $\frac{1}{2}$ as long as broad, smooth; occipital process angular; frontal fontanelle sole-shaped, $\frac{1}{4}$ length of head, twice as long as occipital fontanelle, which is in advance of occipital process; eye 3 times in length of snout, 5 times in interorbital width, which is about $\frac{1}{3}$ length of head and equals width of mouth; band of præmaxillary teeth 4 times as long as broad; vomerine teeth conical, forming a crescentic band which, in the middle, is a little broader than the præmaxillary band; nasal barbel $\frac{3}{5}$, maxillary barbel $\frac{4}{5}$, outer mandibular $\frac{3}{4}$ length of head. Gill-rakers about 20 on anterior arch. Clavicles concealed under the skin. Dorsal 83, its distance from occipital process $\frac{1}{3}$ length of head. Anal 68. Both dorsal and anal embracing root of caudal. Pectoral $\frac{2}{5}$ length of head, its spine

Text-fig. 256.



Clarias fouloni.

serrated on inner side only and measuring $\frac{3}{4}$ the length of the fin. Ventral once and $\frac{3}{4}$ as distant from caudal as from end snout. Caudal nearly $\frac{1}{2}$ length of head. Blackish brown, belly paler brown.

Total length 200 millim.

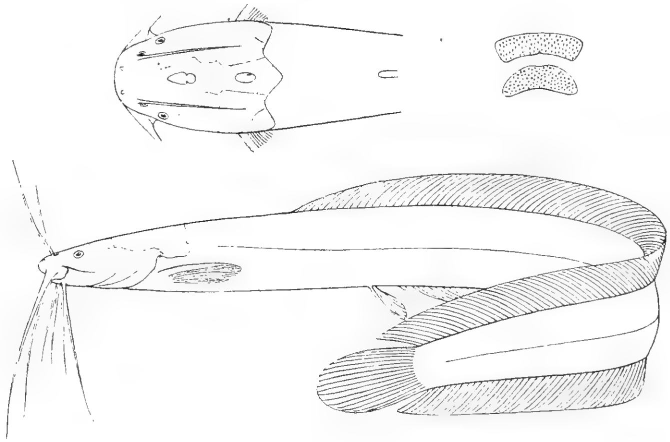
Lake Bangwelu.

32. Clarias salæ.

Hubrecht, Notes Leyd. Mus. iii. 1881, p. 68; Steindachner, op. cit. xvi. 1894, p. 52.

Depth of body 9 to 12 times in total length, length of head 5 to 6 times. Head about $1\frac{1}{2}$ as long as broad, finely granulate above; occipital process short, rounded or very obtusely pointed; frontal fontanelle oval or sole-shaped, about twice as long as broad; occipital fontanelle smaller, in advance of occipital process; eye small, its diameter $2\frac{1}{2}$ to 3 times in length of snout, 4 to $5\frac{1}{2}$ times in interorbital width, which equals width of mouth and $\frac{2}{5}$ length of head; band of præmaxillary teeth 4 times as long as broad; vomerine teeth conical, forming a crescentic band which is nearly as broad as the præmaxillary band; nasal barbel $\frac{2}{3}$ length of head; maxillary barbel a little longer than head, reaching end of pectoral; inner mandibular barbel $\frac{3}{5}$ length of head, nearly $\frac{2}{3}$ length of outer. Gill-rakers few, 8 to 10 on first arch. Clavicles distinct under the thin skin, striated. Dorsal 89–93, its distance from occipital process $\frac{3}{5}$ to $\frac{2}{3}$ length of head. Anal 70–78. Dorsal and anal connected with base of caudal by a narrow membrane. Pectoral $\frac{1}{2}$ length of head, the spine strongly serrated on both sides, $\frac{3}{4}$ the length of the fin. Ventrals nearly twice as far from the caudal as from end of

Text-fig. 257.



Clarias salæ.

snout. Caudal $\frac{3}{5}$ length of head. Blackish-brown or dark green above, with or without small yellowish spots.

Total length 360 millim. Reaches to 435 millim.

Liberia.

2. Allabenchelys.

Boulenger, Proc. Zool. Soc. 1902, i. p. 234.

Two species:—

Depth of body 7–8½ times, head 5–5½ times in total length; ventral 1½–1⅔ as distant from root of caudal as from end of snout; D. 65–75, A. 60–65	1. *A. brevior* Blgr.
Depth of body 9–12 times, head 5½ to 6 times in total length; ventral 1¾ to 2 as distant from root of caudal as from end of snout; D. 80–90, A. 60–75	2. *A. longicauda* Blgr.

1. Allabenchelys brevior.

Boulenger, Ann. & Mag. N. H. (7) xii. 1903, p. 439.

Depth of body 7 to $8\frac{1}{2}$ times in total length, length of head 5 to $5\frac{1}{2}$ times. Head $1\frac{1}{4}$ to $1\frac{1}{3}$ times as long as broad, smooth above, the bony casque, in the middle of the head, about $\frac{1}{2}$ width of head; postorbital bone narrow; supraoccipital process acutely pointed; a small frontal fontanelle; occipital fontanelle a little smaller, partly on occipital process; eye very small, $2\frac{1}{2}$ to 3 times in length of snout, 5 to 6 times in interorbital width which is $\frac{2}{5}$ length of head; band of præmaxillary teeth 3 to 4 times as long as broad; vomerine teeth conical or subgranular, forming a crescentic band which is as broad as or a little broader than the præmaxillary band; nasal barbel $\frac{3}{5}$ to $\frac{2}{3}$ length of head; maxillary barbel as long as or a little shorter than head, not reaching beyond middle of pectoral fin; outer mandibular barbel $\frac{2}{3}$ to $\frac{3}{4}$ length of head, inner $\frac{1}{2}$ to $\frac{3}{5}$. Gill-rakers moderately long, 10 to 12 on anterior arch. Clavicles hidden under the skin. Dorsal 65–75, its distance from occipital process $\frac{2}{3}$ to $\frac{3}{4}$ length of head. Anal 60–65. Both dorsal and anal narrowly separated from caudal. Pectoral about $\frac{1}{2}$ length of head, its spine feebly serrated on both sides and $\frac{1}{2}$ to $\frac{2}{3}$ the length of the fin. Ventral once and $\frac{1}{2}$ to once and $\frac{2}{3}$ as distant from root of caudal as from end of snout. Caudal $\frac{1}{2}$ to $\frac{3}{5}$ length of head. Olive-brown above, yellowish beneath; anal with a light edge.

Total length 205 millim.

Ja and Nyong Rivers, S. Cameroon.

2. Allabenchelys longicauda.

Boulenger, Proc. Zool. Soc. 1902, i. p. 234, pl. xxii. fig. 1.

Depth of body 9 to 12 times in total length, length of head $5\frac{1}{2}$ to 6 times. Head $1\frac{1}{4}$ to $1\frac{1}{3}$ times as long as broad, smooth above, the bony casque, in the middle of the head, $\frac{1}{3}$ width of head; postorbital bone narrow; supraoccipital process acutely pointed; a small frontal fontanelle; occipital fontanelle very indistinct; eye very small, 3 to 4 times in length of snout, 6 times in interorbital width, which is not quite $\frac{1}{2}$ length of head; band of præmaxillary teeth 4 to 5 times as long as broad; vomerine teeth conical or subgranular, forming a crescentic band which is as broad as or a little broader than the præmaxillary band; nasal barbel $\frac{1}{2}$ to $\frac{2}{3}$ length of head; maxillary barbel as long as or a little longer than head, reaching middle or extremity of pectoral fin; outer mandibular barbel $\frac{2}{3}$ to once length of head, inner mandibular $\frac{1}{2}$ to $\frac{3}{5}$. Gill-rakers moderately long, 10 to 12 on anterior arch. Clavicles hidden under the skin. Dorsal 80–90, its distance from the occipital process $\frac{3}{5}$ to $\frac{2}{3}$ length of head. Anal 60–75. Both dorsal and anal very narrowly separated from caudal. Pectoral $\frac{1}{2}$ to $\frac{3}{5}$ length of head, spine smooth or slightly serrated. Ventral $1\frac{3}{4}$ to 2 times distant from root of caudal as from end of snout. Caudal about $\frac{2}{3}$ length of head. Dark olive-brown above, whitish beneath, anal with a light edge; an ill-defined dark, light-edged crescentic band on the caudal.

Total length 280 millim.

Ja and Kribi Rivers, S. Cameroon.

3. Clariallabes.

Boulenger, Ann. Mus. Congo, Zool. i. 1900, p. 136, and Poiss. Bass. Congo, p. 262 (1901).

A single species.

1. Clariallabes melas.

Clarias melas Boulenger, Ann. & Mag. N. H. (5) xix. 1887, p. 148.

Clariallabes melas Boulenger, ll. cc., and Proc. Zool. Soc. 1902, i. pl. xxii. fig. 2.

Depth of body 10 to 11 times in total length, length of head 6 times. Head once and $\frac{1}{2}$ as long as broad, smooth, the bony casque, in the middle, about $\frac{1}{2}$ width of head; supraoccipital process acutely pointed; frontal fontanelle sole-shaped, twice and $\frac{1}{2}$ as long as broad; occipital fontanelle smaller, oval, partly on occipital process; eye very small, its diameter 4 times in length of snout, 7 times in interorbital width, which is $\frac{1}{3}$ length of head and a little less than width of mouth; band of præmaxillary teeth hardly 4 times as long as broad; vomerine teeth pointed, forming a crescentic band which is a little narrower than the præmaxillary band; nasal barbel $\frac{3}{5}$ to $\frac{2}{3}$ length of head; maxillary barbel nearly as long as head; inner mandibular barbel $\frac{2}{3}$ to $\frac{4}{5}$ length of head, outer nearly as long as head. Gill-rakers moderately long, 12 to 15 on anterior arch. Clavicles scarcely distinguishable under the skin. Dorsal 105–115, its distance from occipital process $\frac{1}{2}$ length of head. Anal 88–90. Both dorsal and anal united with caudal, which measures $\frac{1}{2}$ length of head. Pectoral nearly $\frac{1}{2}$ length of head, its spine serrated on both edges and about $\frac{2}{3}$ the length of the fin. Ventral $1\frac{2}{3}$ to 2 times distant from root of caudal as from end of snout. Uniform blackish brown.

Total length 260 millim.

Lower Congo.

4. Gymnallabes.

Günther, Ann. & Mag. N. H. (3) xx. 1867, p. 111.

A single species.

1. Gymnallabes typus.

Günther, l. c. pl. ii. fig. A.

Depth of body 14 to 15 times in total length, length of head $7\frac{1}{2}$ to $8\frac{1}{2}$ times. Head about once and $\frac{1}{2}$ as long as broad, the width of the bony part, in the middle, $\frac{1}{7}$ to $\frac{1}{5}$ width of head; supraoccipital process acutely pointed; eye very small; interorbital width less than width of mouth, about $\frac{1}{3}$ length of head; band of præmaxillary teeth 3 to $3\frac{1}{2}$ times as long as broad; vomerine teeth pointed, forming a crescentic band which is narrower than the præmaxillary band; a much developed lobe at the angle of the mouth; nasal barbel $\frac{2}{3}$ to $\frac{5}{6}$ length of head; maxillary barbel a little longer than head; inner mandibular barbel $\frac{2}{3}$ to $\frac{3}{4}$ length of head, outer a little shorter than head. Gill-rakers moderately long, 10 on anterior arch. Clavicles hidden under the skin. Dorsal 98–110, its distance from occipital process $\frac{3}{5}$ to $\frac{3}{4}$ length of head. Anal 82–88. Dorsal and anal completely united with caudal, which is $\frac{2}{3}$ to $\frac{5}{6}$ length of head

Pectoral $\frac{1}{3}$ to $\frac{2}{5}$ length of head, with a very short smooth spine. Ventral 2 to $2\frac{1}{2}$ times as distant from root of caudal as from end of snout. Uniform blackish brown, lighter brown on the belly.

Total length 230 millim.

Lower Niger and Old Calabar.

5. Channallabes.

Günther, Ann. & Mag. N. H. (4) xii. 1873, p. 143; Boulenger, Poiss. Bass. Congo, p. 263 (1901).

A single species.

1. Channallabes apus.

Gymnallabes apus Günther, t. c. p. 142.

Channallabes apus Boulenger, op. c. p. 264.

Body extremely elongate and serpentiform; length of head 10 to 14 times in total length. Head $1\frac{1}{4}$ to $1\frac{1}{2}$ times as long as broad; supraoccipital process acutely pointed; a sole-shaped frontal fontanelle; an oval occipital fontanelle, partly on the occipital process; eye extremely small, nearly hidden under the skin in the adult; band of præmaxillary teeth 3 times as long as broad; vomerine teeth pointed, forming a crescentic band which is a little narrower; nasal barbel $\frac{3}{5}$ to $\frac{2}{3}$ length of head; maxillary barbel as long as head or slightly shorter; inner mandibular barbel a little shorter than the nasal, outer mandibular a little shorter than the maxillary. Gill-rakers moderately long, 9 to 10 on anterior arch. Dorsal 140–150, separated from occipital process by a space equal to or greater than length of head. Anal 125–130. Dorsal and anal completely united with caudal. Pectoral absent or reduced to a minute rudiment without spine. No trace of ventral. Vent at the anterior fourth of the total length. Uniform dark brown or black.

Total length 310 millim.

Congo and Angola.

6. Heterobranchus.

Geoffroy, Descr. Egypte, Poiss. (1809), part; Günther, Cat. Fish, v. p. 21 (1864); Boulenger, Poiss. Bass. Congo, p. 265 (1901), and Fish. Nile, p. 300 (1907).

Three species from Africa, and one from the Malay Archipelago.

Synopsis of the Species.

D. 38–45; adipose fin $\frac{2}{3}$–$\frac{3}{4}$ length of rayed dorsal; pectoral not more than $\frac{1}{2}$ length of head; 20–30 gill-rakers on anterior arch.................................. 1. *H. bidorsalis* I. Geoffr.

D. 29–34; adipose fin as long as or a little shorter than rayed dorsal; pectoral not more than $\frac{1}{2}$ length of head; 20–30 gill-rakers on anterior arch .... 2. *H. longifilis* C. & V.

D. 30–32; adipose fin as long as or a little shorter than rayed dorsal; pectoral $\frac{2}{3}$ length of head; 18–20 gill-rakers on anterior arch .... 3. *H. isopterus* Blkr.

1 HETEROBRANCHUS BIDORSALIS.

I. Geoffroy, Descr. Egypte, Poiss. p. 305, pl. xvi. figs. 2 & 5, & pl. xvii. figs. 8 & 9 (1827); Günther, Petherick's Trav. ii. p. 220 (1869); Bouleng. Fish. Nile, p. 300, pl. liv. fig. 1 (1907).

Heterobranchus geoffroyi Cuvier & Valenciennes, Hist. Poiss. xv. p. 392 (1840).

Heterobranchus senegalensis Cuvier & Valenciennes, t. c. p. 397; Steindachner, Sitzb. Ak. Wien, lx. 1869, p. 980.

Heterobranchus intermedius Günther, Cat. Fish. v. p. 22 (1864); and l. c.

Depth of body 6 to 9 times in total length, length of head $2\frac{4}{5}$ to $3\frac{1}{4}$ times. Head very strongly depressed, $1\frac{1}{4}$ to $1\frac{1}{2}$ times as long as broad, its upper surface coarsely granulate in the adult; occipital process pointed, sometimes very obtusely; frontal fontanelle knife-shaped, 3 to 4 times as long as broad, 3 to 5 times in length of head; occipital fontanelle small, in advance of occipital process; eye 3 (young) to $6\frac{1}{2}$ times in length of snout, 6 to $10\frac{1}{2}$ times in interorbital width; width of mouth a little less than interorbital width; band of præmaxillary teeth about 5 times as long as broad; vomerine teeth also villiform, forming a crescentic band which is $1\frac{1}{4}$ to $1\frac{1}{2}$ times as broad as the præmaxillary band and may have a small central posterior process; nasal barbel $\frac{2}{3}$ to once length of head; maxillary barbel $\frac{4}{5}$ to once and $\frac{6}{7}$ length of head, extending to extremity of pectoral or between this point and root of ventral; outer mandibular barbel $1\frac{1}{10}$ to $1\frac{1}{2}$ times as long as inner, which measures 1 to $1\frac{1}{2}$ times length of head. Gill-rakers rather short, 20 to 30 on anterior arch. Dorsal 38 to 45, its distance from occipital process $\frac{1}{10}$ to $\frac{1}{6}$ length of head; adipose dorsal $\frac{2}{5}$ to $\frac{2}{3}$ as long as, as deep as or lower than, and commencing immediately behind, rayed dorsal, extending to base of caudal. Anal 50 to 57, extending to base of caudal. Pectoral fin $\frac{2}{5}$ to $\frac{1}{2}$ length of head, the spine smooth and measuring $\frac{2}{3}$ to $\frac{3}{4}$ the length of the fin. Ventral midway between end of snout and base of caudal, or a little nearer the latter. Caudal $\frac{2}{5}$ to $\frac{1}{2}$ length of head. Dark olive above, whitish beneath; a dull orange or red edge to the dorsal, adipose, and caudal fins.

Total length 770 millim.; grows to 1220.

Nile, Chad Basin, Senegal, Niger.

2. HETEROBRANCHUS LONGIFILIS.

Cuvier & Valenciennes, Hist. Poiss. xv. p. 394, pl. ccccxlvii. (1840); Günther, Cat. Fish. v. p. 22 (1864), and Petherick's Trav. ii. p. 221 (1869); Boulenger, Fish. Nile, p. 303, pl. liv. fig. 2 (1907).

Heterobranchus laticeps Peters, Mon. Berl. Ac. 1852, p. 682, and Reise Mossamb. iv. p. 37, pl. vii. fig. 1 (1868); Boulenger, Poiss. Bass. Congo, p. 265 (1901).

Depth of body 6 to 8 times in total length, length of head 3 to $3\frac{2}{3}$ times. Head less strongly depressed than in the preceding species, $1\frac{1}{3}$ to $1\frac{2}{3}$ times as long as broad, its upper surface coarsely granulate in the adult; occipital process acutely pointed; frontal fontanelle knife-shaped, $2\frac{1}{2}$ to 4 times as long as broad, $3\frac{1}{2}$ to $6\frac{1}{2}$ times in length of head; occipital fontanelle small, in advance of occipital process; eye $2\frac{1}{2}$ (very young) to $4\frac{1}{2}$ times in length of snout, 4 to 9 times in interorbital width; width of mouth a little less than interorbital width; band of præmaxillary teeth 5 to 6 times as long as broad; vomerine teeth also villiform, forming a crescentic band which is nearly as broad as or a little broader than præmaxillary band; nasal barbel $\frac{1}{2}$ to once length of head; maxillary barbel $1\frac{1}{5}$ to 2 times length of head, extending to end of the pectoral or between this point and origin of anal; outer mandibular barbel $1\frac{1}{2}$ to $1\frac{3}{4}$ times as long as inner, which measures $\frac{1}{2}$ to nearly once length of head. Gill-rakers rather short, 20 to 30 on anterior arch. Dorsal 29 to 34, its distance from occipital process $\frac{1}{7}$ to $\frac{1}{3}$ length of head; adipose dorsal as long as or a little shorter and lower than rayed dorsal, commencing immediately behind or at a short distance from the latter. Anal 44 to 54, extending, like the adipose dorsal, to the base of the caudal fin. Pectoral $\frac{2}{5}$ to $\frac{1}{2}$ the length of the head, the spine feebly serrated on the outer border and measuring $\frac{1}{2}$ (young) to $\frac{6}{7}$ the length of the fin. Ventral midway between end of snout and base of caudal, or a little nearer the latter. Caudal $\frac{1}{2}$ to $\frac{2}{3}$ length of head. Olive above, white beneath, sometimes with scattered black blotches; dorsal and anal fins pale olive, darker towards the edge, which may be margined with red; caudal fin yellowish or pale orange at the base, with a more or less distinct blackish crescentic band, sharply defined in front, shading off to yellow or red behind; adipose dorsal fin often blackish at the end.

Total length 720 millim.

Nile, Omo, Niger, Congo, Zambesi.

3. Heterobranchus isopterus.

Heterobranchus isopterus Bleeker, Nat. Verh. Wetensch. Haarlem, xviii. 1863, no. 2, p. 108, pl. xxii. fig. 1; Günther, Cat. v. p. 23 (1864).

Heterobranchus macronema, Bleeker, l. c. p. 109, pl. xxi. fig. 1.

Depth of body 6 to $6\frac{1}{2}$ times in total length, length of head $3\frac{1}{3}$ to $3\frac{1}{2}$ times. Head $1\frac{2}{5}$ as long as broad, its upper surface finely granulate; occipital process acutely pointed; frontal fontanelle 3 to 4 times as long as broad, 3 to $4\frac{1}{2}$ times in length of head; occipital fontanelle small, in advance of occipital process; eye small, $2\frac{1}{2}$ or 3 times in length of snout, $5\frac{1}{2}$ or 6 times in interorbital width, which is a little less than $\frac{1}{2}$ length of head; width of mouth $\frac{2}{5}$ length of head; band of præmaxillary teeth 5 times as long as broad; vomerine teeth villiform, forming a crescentic band which is as broad as or a little narrower than the præmaxillary band; nasal barbel a little shorter than the head; maxillary barbel $1\frac{1}{5}$ to $1\frac{1}{2}$ times length of head, extending to extremity of pectoral spine or to base of ventral; inner mandibular barbel $\frac{2}{3}$ length of outer, a little shorter than the nasal. 18–20 gill-rakers on first arch. Dorsal 30–32, its distance from occipital process $\frac{1}{3}$ or $\frac{1}{4}$ length of head; adipose dorsal as long as or a little shorter, lower than, and commencing a short distance behind, dorsal proper, narrowly separated from caudal. Anal 41–46. Pectoral $\frac{3}{5}$ length of head, the spine feebly serrated on the outer edge and measuring $\frac{3}{4}$ the length of the fin. Ventrals midway between end of snout and base of caudal. Caudal a little more than $\frac{1}{2}$ length of head. Blackish brown above, whitish beneath; fins with a narrow yellowish margin.

Total length 170 millim.

Gold Coast.

7. Dinotopterus.

Boulenger, Tr. Zool. Soc. xvii. 1906, p. 550.

A single species.

1. Dinotopterus cunningtoni.

Boulenger, l. c. pl. xxxi.

Depth of body $7\frac{1}{2}$ times in total length, length of head $3\frac{2}{5}$ times. Head extremely flattened, once and $\frac{1}{3}$ as long as broad, its upper surface covered with very thin skin and rugose with striæ radiating from the occipital region; frontal fontanelle large, $2\frac{1}{2}$ times as long as broad, $\frac{1}{4}$ length of head; occipital fontanelle very small; a rather long and narrow occipital process; snout broad, truncate, not projecting beyond mouth; eye small, 3 times in length of snout, $7\frac{1}{2}$ times in interorbital width; nasal barbel $\frac{3}{5}$ length of head; maxillary barbel a little longer than head, reaching posterior third of pectoral; outer mandibular barbels once and $\frac{1}{2}$ as long as inner and nearly as long as head. Jaws with bands of minute villiform teeth; similar teeth form a rather broader crescentic band on the vomer. Gill-rakers very long and slender, closely set, about 110 on anterior arch. Dorsal 53, its distance from occipital process $\frac{1}{3}$ length of head; adipose dorsal low and short, in contact with caudal. Anal 43, separated from caudal by a space equal to twice diameter of eye. Pectoral $\frac{1}{2}$ length of head; spine rather weak, not serrated, a little more than half length of fin. Ventral equally distant from end of snout and from root of caudal. Caudal rounded. Dark brown, almost black above, pinkish white beneath.

Described from a single specimen, 500 millim. long, the species said to grow to 1290 millim. In a young specimen, 90 millim. long, the head is less depressed and the eyes are proportionally larger than in the adult; ventrals a little nearer end of snout than root of caudal.

Lake Tanganyika.

3. On a Hæmogregarine from the Blood of a Himalayan Lizard (*Agama tuberculata*). By E. A. MINCHIN, M.A., F.Z.S.

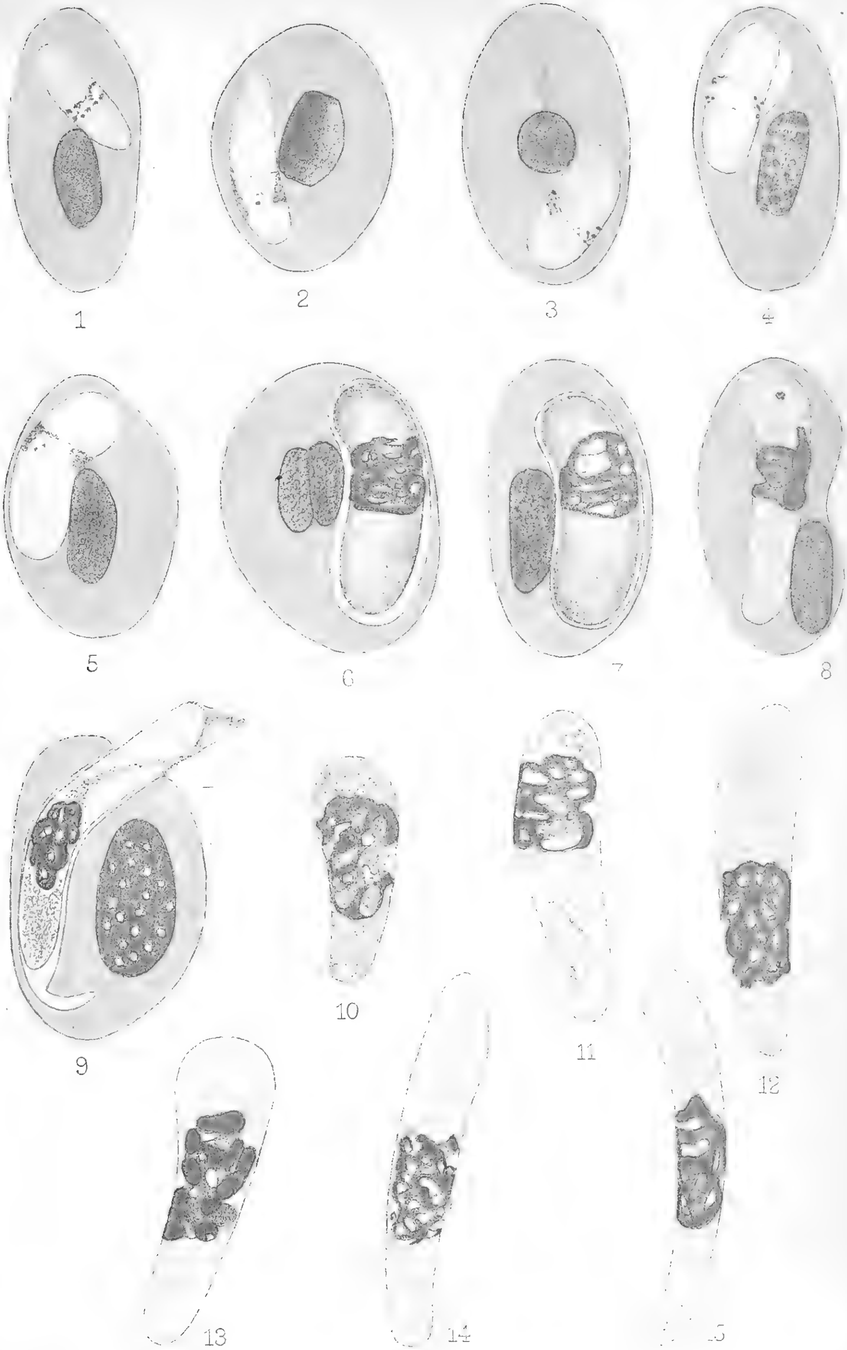
[Received November 15, 1907.]

(Plates LV. & LVI.)

The material upon which the following description is based consists of four slides, bearing smears of the blood of the common rock-lizard of the Himalayas, which were prepared and sent to me from Kasauli by Lt.-Col. F. Wyville-Thomson, I.M.S., to whom my best thanks are due for his kindness in sending me the specimens and entrusting me with the description of them. I shall refer to the slides by the letters A–D. An examination of the slides shows at once that they fall into two pairs, A and B being one pair, C and D the other. While the parasites are very similar, both as regards structure and occurrence, in both the slides of each pair, those of one pair are so different from those found in the other pair of slides that they might easily be taken for distinct species of parasites. At this distance from the habitat of the host and its parasite, and with limited material at my disposal, I can only record these differences, and cannot attempt to explain them.

Preparation of the Slides.—Slide A, alone of the four, was sent to me unfixed; my assistant Dr. Woodcock fixed it in the usual way with methyl alcohol, and stained it for me with Giemsa's modification of the Romanowsky stain, subsequently differentiated with Unna's tannin-orange solution. The other three slides were sent to me already fixed and stained with Leishman's stain, by Lt.-Col. Wyville-Thomson. It is important to note, therefore, that, for aught I know to the contrary, slide B was prepared in the same manner as slides C and D, but in a different way from slide A; so that the resemblances and differences, presently to be described, exhibited by the four slides, cannot be ascribed to like or unlike methods of preparation in each case. The only differences that can be attributed to the action of the stains used are, that in slide A the ground-colour of the red blood-corpuscles is lighter and more yellowish in tint, in B, C, and D darker and more greyish, and that in slide A the nuclei of the red blood-corpuscles and of the parasites scarcely differ in tint, but in B, C, and D the nuclei of the red blood-corpuscles have a distinctly purplish tinge, while the nuclei of the parasites show a more pronounced red colour.

Description of the Parasite.—In all the slides there are to be found both intra-corpuscular forms and free forms, so-called vermicules. The free forms are sufficiently similar to the largest intra-corpuscular forms to warrant the assumption that they have escaped from the corpuscle, and I have twice found parasites apparently in the act of escaping from the corpuscle (Pl. LV. fig. 9).



E. A. M. ad nat. del. West, Newman chr.

HÆMOGREGARINE OF AGAMA TUBERCULATA × 2000.

E.A.M. ad nat. del.

West, Newman chr.

HÆMOGREGARINE OF AGAMA TUBERCULATA × 2000.

The intra-corpuscular forms, in their youngest stages, are placed at the side of the nucleus of the blood-corpuscle, which is then normal in appearance, with the nucleus occupying its proper central position. When the parasite is full-grown, however, the nucleus of the corpuscle is more or less pushed to one side, and may become somewhat irregular in outline; but in no case have I seen the corpuscular nucleus at all broken up, as is known to occur in many cases of reptilian hæmogregarines, hence classed by some authors as a distinct genus *Karyolysus*. I have observed, however, a peculiar relation between the shape of the parasite and the displacement of the corpuscular nucleus. The intra-corpuscular parasite is always distinctly sausage-shaped, and slightly bowed in the plane of the corpuscle. It is reasonable to attribute this curvature to the fact that the parasite, being situated to the side of the corpuscular nucleus, accommodates itself to the space in which it lies (compare figs. 5 & 6, Pl. LV.). We may speak of this as the normal curve of the parasite. But in a few cases we find the curve of the parasite entirely reversed, and its convexity turned towards the nucleus of the corpuscle (Pl. LV. fig. 8, Pl. LVI. figs. 20, 21). In such cases two points are noticeable: first, that the parasites resemble the free forms very closely; secondly, that the corpuscular nucleus is much more displaced than usual, being sometimes pressed quite against the side of the corpuscle (figs. 8 & 20). This point has also been noticed by Lt.-Col. Wyville-Thomson, who has sent me four sketches of the parasite, representing one free and three intra-corpuscular forms: two of the latter show the normal curvature of the parasite, like my fig. 19 on Pl. LVI.; the third, however, shows a reversed curve, with the nucleus of the corpuscle pushed far to the side, as in my fig. 20. I think we shall not be far wrong in attributing these cases of reversed curvature to the commencing activity of a parasite about to become free from the corpuscle, in which the movements of the contractile body not only alter its curvature, but also may have the effect of forcing the nucleus of the corpuscle away to one side.

I will now proceed to describe the structure of the parasite in more detail. Beginning with slides A and B, we find forms of the parasite which may be classified as young intra-corpuscular forms, full-grown intra-corpuscular forms, and free forms or vermicules.

The young intra-corpuscular forms (Pl. LV. figs. 1–5) vary in length from about $\frac{1}{2}$–$\frac{2}{3}$ of the blood-corpuscle; *i. e.*, from about 9–11 μ in length*. They were remarkable in two points: first, their very clear cytoplasm, hyaline and free from granulations, so that they often have the appearance of a space in the blood-corpuscle; and, secondly, their delicate nucleus, which appears to consist of faintly-staining granules and strands of chromatin,

* Since all the figures which accompany this memoir are drawn to a magnification of 2000 linear, it follows that a length of 2 mm. in the drawings corresponds to an actual length of 1 μ in the objects.

forming, so to speak, a band round the waist of the parasite; in many cases, however, it is an "Empire" waist, placed much nearer one end of the body than the other. As I have laboured to reproduce the appearance of the objects in my illustrations, I need not enter into longer descriptions. While, as is shown, some parasites have slightly more chromatin than others, there is nothing that can be said to be in the least transitional to the forms next to be described.

The full-grown intra-corpuscular parasites are at least $\frac{3}{4}$ the length of the blood-corpuscle, *i. e.* about 15–17 μ in length by about 5 μ in breadth. They contrast sharply with the young forms in the characters both of the body and nucleus, but especially the latter (Pl. LV. figs. 6–8). The body appears distinctly contoured and shaded, standing well off from the blood-corpuscle; it sometimes lies in a distinct clear space (figs. 6 & 7), but I could not make out anything of the nature of a capsule surrounding it. The cytoplasm is finely granular and takes a distinct bluish stain; only in one instance did I observe in the cytoplasm what appeared to be a grain of chromatin distinct from the nucleus, in a parasite which appeared to be ripe for escape from the corpuscle (fig. 8). But the nucleus is the most remarkable feature of the parasite at this stage, as compared with the forms described in the preceding paragraph; it is exceedingly rich in chromatin, which forms a deeply staining mass of irregularly spongy texture, occupying the middle region of the body for practically its whole width and nearly one-third of its length. Here, again, I must leave my illustrations to speak for themselves; I think they make the contrast between the young and old forms of the parasite sufficiently plain.

Of the free vermicules, it can be said that they resemble closely the full-grown intra-corpuscular forms. Their principal variations of form and structure are shown on Pl. LV. figs. 10–15; we can distinguish in a general way stumpy forms (fig. 10), medium forms (figs. 11–13), and long forms (figs. 14, 15), the last-named being by far the most abundant. One end of the body is always slightly clubbed, and the nucleus may be nearer to the stouter end, or to the narrower end, or to the middle of the body. The nucleus shows the same spongy structure described above for the intra-corpuscular parasites; it may vary in texture from a coarse to a more finely-knitted texture. Only in one case did I observe a tendency for the chromatin to take the form of more or less distinct masses (fig. 13).

I have figured (Pl. LV. fig. 9) one of the two cases in which I found the vermicule in the act, apparently, of escaping from the corpuscle. But even after examining the preparation by the aid of different objectives and various methods of illumination, I was not able to make up my mind exactly as to how the appearances seen should be interpreted in some points. My impression is that the projecting extremity of the parasite is rounded off, and that the conical pointed end seen in my figure represents something of the nature of a shrivelled sheath pushed out by the parasite. I could not, however, see any distinct line of separation between what I regard as sheath and as body, and it may be that the parasite, at the moment of leaving the corpuscle, has the anterior end irregular in shape. I have tried to depict the object as I saw it, and I must leave the matter there. The other example of this stage which I found was too much obscured by neighbouring blood-corpuscles to be made out clearly.

To complete my study of these slides, I made some counts of the different forms occurring in each. This was done with the help of the mechanical stage, going methodically over a part of the smear, so as to make sure that the same forms were not seen twice, and counting all the forms met with. The following is the result for slides A and B:—

	Young intra-corpuscular forms (figs. 1–5).	Full-grown intra-corpuscular forms (figs. 6–8).	Vermicules. Long (fig. 15).	Vermicules. Medium (fig. 11).	Vermicules. Stumpy (fig. 10).
Slide A	14	5	...	93	...
Slide B	24	28	60	10	11

To these figures must be added the two parasites in the condition of fig. 9, found on slide B. It is seen that on both slides the free vermicules greatly preponderate, though this is less marked on slide B than on slide A; and the more detailed count made of slide B shows that long forms of the vermicules are greatly in excess of shorter forms.

The other two slides, C and D, show a very different state of things. In the first place, free vermicules are comparatively rare, and young forms, poor in chromatin, like those described above, are not found at all. The majority of the parasites met with are intra-corpuscular forms similar to that depicted in fig. 19, on Pl. LVI. The parasite has the form of an elongated sausage, slender and drawn out, in very marked contrast to the stout forms already described (compare figs. 6 and 7); the normal curve is concave on the side towards the corpuscular nucleus. The cytoplasm of the body is usually clear and free from coarse granulations. But the most remarkable feature of the parasite is its nucleus, which forms a band or zone at the middle of the body, equal in width to nearly half the length of the body. The chromatin is arranged in the form of transverse strands, which seem to wrap round the body in this region; between the strands of chromatin clear spaces are seen, in some specimens abundantly, while in other cases the texture may be closer and the structure more compact. The strands of chromatin often appear to bulge beyond the contour of the parasite, a point which Lt.-Col. Wyville-Thomson has remarked upon in his letter to me, and has depicted in the accompanying pencil-sketches. Nothing could be more different than the appearance of the nucleus of the parasite in these two slides C and D and that seen in slides A and B already described; I think my figures show this point with sufficient clearness.

Besides the slender elongated forms just described, there are found also (but less commonly) short, stumpy intra-corpuscular parasites (Pl. LVI. figs. 17, 18)—not in the least comparable, however, to the young forms found on slides A and B. They give me the impression, rightly or wrongly, of being dwarfed, stunted forms, which for some reason have not attained their full growth. Their nucleus is as large as, or even larger than, that of the long forms, and has the same type of structure, with the fenestrations even more apparent in many cases; it occupies at least half, sometimes much more than half, the length of the body, leaving two clear poles free from chromatin at either end.

A third type of intra-corpuscular parasite, found in a few cases (figs. 20, 21), was also stouter than the more elongated forms, and noteworthy for the presence of red-staining granules, apparently chromidia, in the cytoplasm outside the nucleus. Since these forms resemble, as will be shown, the free vermicules in this feature—and since they frequently occur with reversed curvatures, as seen in the figures—I am inclined to regard these stouter forms as ripe parasites, ready to escape from the blood-corpuscle.

In one single instance I was so fortunate as to find a doubly-infected blood-corpuscle (fig. 16). The two contained parasites can be seen to be below the normal in size, and one is much smaller than the other; both, however, show abundance of chromatin in the nucleus, and I am inclined to regard their small size as a result of their being stunted in growth owing to lack of sufficient space or nutriment for their proper development.

Free vermicules, as already stated, were scarce in these preparations, and I only saw one which might have been one of the long forms, but as it was obscured by overlying blood-corpuscles, I could not be sure of it. One stumpy form was also found. All the others seen were of what I should term medium length (figs. 22, 23). Their nucleus was similar to the intra-corpuscular forms, but with a tendency to be more compact. But their most marked feature was the presence in their cytoplasm of distinct red-staining granules, apparently of the nature of chromidia; in this point they contrast sharply with the vermicules seen on slides A and B, in which the cytoplasm always appeared free from such granules.

A count of these two slides, carried out in the manner already described, gave the following results:—

	Large intra-corpuscular forms (figs. 19, 20).	Stumpy intra-corpuscular forms (figs. 17, 18).	Vermicules.		
			Stumpy.	Medium (figs. 22, 23).	Long.
Slide C	151	6	0	2	1?
Slide D	137	1	1	3	0

These figures, to which must be added the doubly-infected corpuscle shown in fig. 16 from slide C, show that by far the greater proportion of the parasites on these slides are full-grown intra-corpuscular forms.

Comparing the results obtained from all the four slides which I have been able to study, I am inclined to explain the differences between them in the following way:—the parasites on slides C and D (Pl. LVI.) are probably all of the same age, and represent one generation of the parasite, possibly one infection of the host; on the other hand, in slides A and B (Pl. LV.) there are probably two generations of the parasite, resulting, it may be, from two distinct infections of the host, represented respectively by the young forms (figs. 1–5) and the older, free or intra-corpuscular, forms (figs. 6–15). This explanation does not, however, account for the very curious differences between the nuclei seen in the two cases.

No forms of multiplication were seen by me nor by Lt.-Col. Wyville-Thomson, who writes:—"No schizonts were found in either liver or spleen, nor any multiplying forms seen in the blood, all appearing to be at the same stage of development." (These remarks appear, from the sketches made, to apply more particularly to slides C and D.)

Position of the Parasite.—It is evident that the parasite is a typical example of the genus *Hæmogregarina* Danilewsky, in the wide sense; its shortness, relative to the blood-corpuscle which contains it, is one of the points characterising Labbé's genus *Karyolysus*, described originally from lizards, but now known to occur also in other reptiles. It is, however, also characteristic of the species of *Karyolysus* to cause the nucleus of the blood-corpuscle to break up, which this species does not do. In any case the characters by which *Karyolysus* are defined are hardly to be considered of generic value, and its species are best ranked under *Hæmogregarina* until more is known about them. In the species under consideration, I was often struck by its resemblance to the genus *Halteridium* occurring in birds, especially in cases where the parasite is pressed against the nucleus of the blood-corpuscle (compare fig. 7 on Pl. LV.).

Since the species does not appear to have been described before, I propose for it the name *Hæmogregarina thomsoni*, in honour of its discoverer, Lt.-Col. Wyville-Thomson. Should it prove, eventually, to be the case that the parasites on slides A and B (Pl. LV.) are a distinct species from those on slides C and D (Pl. LVI.), I would restrict the name to the latter.

I should like, however, to make a few remarks about the naming of new species of blood-parasites. It is a common practice, which I am here following, to consider a species of blood-parasite as new if it is found in a host in which parasites of that class have not been found or described previously. The assumption underlying this procedure is that different species of animals tend to have distinct species of parasites—an assumption, however, which stands in need of support, for it is quite conceivable that the same species of parasite might infest several species of hosts, and even that the difference of hosts might cause it to appear under forms more or less different in different cases. To regard parasites as being necessarily of distinct species because they occur in distinct hosts is, in reality, not more warranted than the procedure of those naturalists who give distinct names to animals occurring in different geographical regions, even if they do not differ in any other characters, thus begging the question of their specific distinctness. It must be understood, therefore, that the name given to this parasite must be considered as purely provisional and liable to be cancelled, that is merged in some older name, with increased knowledge of these parasites. Names given to parasites distinguished, in the first instance, by the specific distinctness of their hosts must not be taken as necessarily denoting distinct natural species (though this will be true of them in the great majority of cases), but merely, so to speak, as labels affixed to certain classes of objects, whereby they become represented by parts of speech and can be referred to briefly.

So many species of hæmogregarines are now known from various animals that it is almost necessary to apologise for adding another to the list; I do so with the object of drawing attention to it in the hope that someone may be brought thereby to study its complete life-history. In the present state of our knowledge, it is not new species of hæmogregarines that are needed, but rather new facts about old species.

EXPLANATION OF THE PLATES.

Plate LV.

Figs. 2–7, 10–12, & 14 are drawn from slide A; all other figures on the Plate are from slide B. All the figures are magnified 2000 linear.

Figs. 1–5, young intra-corpuscular forms.
Figs. 6–8, full-grown intra-corpuscular forms.
Fig. 9, vermicule in the act of leaving the corpuscle.
Figs. 10–15, free vermicules.

Plate LVI.

Figs. 16, 17, 19, & 22 are drawn from slide C; all others from slide D. All the figures are magnified 2000 linear.

Fig. 16, corpuscle infected with two parasites
Figs. 17–21, intra-corpuscular parasites.
Figs. 22, 23, free vermicules.

Lister Institute of Preventive Medicine,
15th Nov., 1907.

INDEX.

THE END.

Printed by TAYLOR and FRANCIS, Red Lion Court, Fleet Street.

No. 48.

ABSTRACT OF THE PROCEEDINGS

OF THE

ZOOLOGICAL SOCIETY OF LONDON.*

November 12th, 1907.

F. DuCane Godman, Esq., D.C.L., F.R.S., Vice-President, in the Chair.

The Secretary read a report on the additions that had been made to the Society's Menagerie during the months of June, July, August, September, and October, 1907.

Mr. R. I. Pocock, Superintendent of the Gardens, exhibited photographs of a hybrid between the European and African Wild Cats (*Felis sylvestris* and *F. ocreata*).

Mr. R. Lydekker, F.R.S., F.Z.S., exhibited on behalf of the Hon. Walter Rothschild, F.Z.S., the skins and horns of a male and female Takin from Bhutan, differing from the typical Mishmi form by their much smaller horns.

Mr. E. S. Goodrich, M.A., F.R.S., F.Z.S., read a communication, illustrated by diagrams, "On the Scales of Fishes," in which he called attention to differences in the structure of these organs and to their importance in classification.

A paper was read by Messrs. Oldfield Thomas, F.R.S., F.Z.S., and R. C. Wroughton, F.Z.S., on Mammals collected at Beira by Mr. C. H. B. Grant, being No. VIII. of the series of papers on the Rudd Exploration of South Africa. Twenty-eight species were included in the collection, represented by 127 specimens, all, as before, presented to the National Museum by Mr. C. D. Rudd.
The region not having been previously worked, the series was of much interest from a geographical point of view.

---

* This Abstract is published by the Society at 3 Hanover Square, London, W., on the Tuesday following the date of Meeting to which it refers. It will be issued, free of extra charge, to all Fellows who subscribe to the Publications, along with the 'Proceedings'; but it may be obtained on the day of publication at the price of *Sixpence*, or, if desired, sent post-free for the sum of *Six Shillings* per annum, payable in advance.

Mr. R. Lydekker, F.R.S., F.Z.S., directed attention to a figure of the type of *Elephas africanus cyclotis* with which he was unacquainted at the time of reading his paper on African Elephants (P. Z. S. 1907, p. 380). He also exhibited and described the skin of a Leopard brought home by Mr. Stanley Tomkins from Uganda, remarkable for the shortness of the limbs and tail and the Jaguar-like pattern of the markings.

Dr. P. Chalmers Mitchell, F.R.S., Secretary to the Society, gave an account of observations made by himself and Mr. R. I. Pocock, Superintendent of the Gardens, on the Feeding of Serpents in Captivity. He described the different habits of Python-like, non-poisonous and poisonous Colubrine and Viperine Snakes, and stated that he and Mr. Pocock had found no evidence as to the existence of a specific fear of Snakes in the case of any vertebrates except Primates, and that, amongst Primates, Lemurs were distinguished from true Monkeys by their complete indifference to Snakes.

Mr. C. Tate Regan, M.A., F.Z.S., read a paper containing descriptions of some new Loricariid fishes, viz. five species of *Plecostomus* and an *Otocinclus* from Eastern Brazil and two species of *Arges* from Colombia.

Lt.-Col. N. Manders, F.Z.S., presented a communication entitled "Notes on Mayer's Pigeon," in which the habits of this nearly extinct bird were described.

Mr. F. E. Beddard, F.R.S., F.Z.S., Prosector to the Society, communicated the results of his observations on the structure of the rare Madagascar mammal, *Galidictis striata*.

The next Meeting of the Society for Scientific Business will be held on Tuesday, the 26th November, 1907, at half-past Eight o'clock P.M., when the following communications will be made:—

1. The Rev. O. Pickard-Cambridge, M.A., F.R.S., C.M.Z.S.—On some New and Little-known Araneidea.

2. Mr. M. Jacoby, F.E.S.—Descriptions of new Species of South American *Cryptocephalini*.

3. Dr. K. Andersen.—A Monograph of the Chiropteran Genera *Uroderma*, *Enchisthenes*, and *Artibeus*.

4. Mr. E. S. Russell, M.A.—Environmental Studies on the Limpet.

5. Mr. F. E. Beddard, M.A., F.R.S.—Contributions to the Knowledge of the Anatomy of the Batrachian Family *Pelobatidæ*.

6. Lord Walsingham, M.A., LL.D., F.R.S.—On the Micro-lepidoptera of Tenerife.

7. Mr. J. Hopkinson, F.L.S.—Dates of Publication of the separate parts of Gmelin's Edition (13th) of the 'Systema Naturæ' of Linnæus.

The following Papers are in hand :—

1. Dr. R. Broom, D.Sc., C.M.Z.S.—On the Origin of the Mammal-like Reptiles.

2. Mr. G. A. Boulenger, F.R.S., V.P.Z.S.—A Revision of the African Silurid Fishes of the Subfamily *Clariinæ.*

Communications intended for the Scientific Meetings of the Zoological Society of London should be addressed to

P. CHALMERS MITCHELL, *Secretary.*

3 Hanover Square, London, W.
November 19*th*, 1907.

No. 49.

ABSTRACT OF THE PROCEEDINGS

OF THE

ZOOLOGICAL SOCIETY OF LONDON.*

November 26th, 1907.

G. A. Boulenger, Esq., F.R.S., Vice-President, in the Chair.

The Secretary exhibited an oil-painting by Mr. W. Walls, R.S.A., of a young female Gorilla recently living in the Society's Gardens.

The Secretary presented, on behalf of the Rev. O. Pickard-Cambridge, M.A., F.R.S., C.M.Z.S., a communication entitled "On some New and Little-known Araneidea." Eleven species were noted or described and figured: one from Lagos, Portugal; three from Cape Colony, S. Africa; one from Mashonaland; five from the Canaries; and one from Old Calabar. Seven species were described as new to science. Five of the Spiders had been accidentally imported to England in packages of bananas.

A paper was read from Mr. M. Jacoby, F.E.S., describing new species of Beetles of the Cryptocephaline division of the family *Chrysomelidæ*, from tropical South America.

The Secretary communicated a paper by Mr. E. S. Russell, M.A., the object of which was to correlate certain modifications of the Limpet-shell (*Patella vulgata*) with definite environmental conditions. The method adopted by the author had been to measure the dimensions of a large number of shells from one environment and to compare them with similar measurements of

---

* This Abstract is published by the Society at 3 Hanover Square, London, W., on the Tuesday following the date of Meeting to which it refers. It will be issued, free of extra charge, to all Fellows who subscribe to the Publications, along with the 'Proceedings'; but it may be obtained on the day of publication at the price of *Sixpence*, or, if desired, sent post-free for the sum of *Six Shillings* per annum, payable in advance.

shells from a second environment. The author had found the Limpet a suitable animal for such investigations, as all Limpets above 15 mm. "home" accurately. Limpets from high-water localities were found to be larger, broader, and higher, but narrower in proportion than those from low-water localities. Limpets from exposed localities were lower, narrower, thicker, and more irregular in outline than those from sheltered spots. On the area from which the shells were collected, two types occurred—a "rough" type with strong coarse ribs and irregular margin, associated with rough stones, and a "smooth" type on polished stones.

Mr. F. E. Beddard, F.R.S., Prosector to the Society, gave an account of a communication on the Anatomy of the Batrachian family *Pelobatidæ*, based chiefly on material he had obtained from the Society's Collection.

A paper by Lord Walsingham, LL.D., F.R.S., F.Z.S., described the Microlepidoptera of Tenerife.

The Secretary communicated a paper by Mr. John Hopkinson, F.L.S., entitled "Dates of Publication of the separate Parts of Gmelin's Edition (13th) of the 'Systema Naturæ' of Linnæus." The paper stated that the first volume of this edition, containing the Animal Kingdom, was in seven parts, with a date, 1788, in the first part only, but that there was internal evidence of a later date of issue of subsequent parts. Investigations in the Library of the British Museum had revealed the years of publication with some indication also of the period of the year in which each part appeared. The dates were: pt. 1, 1788; pts. 2 & 3, 1789; pts. 4 & 5, 1790; pt. 6, 1791; pt. 7, 1792.

The second volume, containing the Vegetable Kingdom, was in two parts, and the date of issue of part 2 had been found to be 1792. Contemporary authorities were given for the dates.

Mr. R. I. Pocock, F.L.S., Superintendent of the Society's Gardens, reported on a small collection of Mammalia brought from Liberia by Mr. Leonard Leighton. The paper recorded the presence in Liberia of two mammals hitherto unknown from that locality, and contained descriptions of one species of Genet and one Linsang new to science.

The next Meeting of the Society for Scientific Business will be held on Tuesday, the 10th December, 1907, at half-past Eight o'clock P.M., when the following communications will be made:—

1. Dr. R. Broom, D.Sc., C.M.Z.S.—On the Origin of the Mammal-like Reptiles.

2. Mr. G. A. Boulenger, F.R.S., V.P.Z.S.—A Revision of the African Silurid Fishes of the Subfamily *Clariinæ*.

3. Prof. E. A. Minchin, M.A., F.Z.S.—On a Hæmogregarine from the Blood of a Himalayan Lizard (*Agama tuberculata*).

Communications intended for the Scientific Meetings of the Zoological Society of London should be addressed to

P. CHALMERS MITCHELL, *Secretary*.

3 Hanover Square, London, W.
December 3rd, 1907.

No. 50.

ABSTRACT OF THE PROCEEDINGS

OF THE

ZOOLOGICAL SOCIETY OF LONDON.*

December 10th, 1907.

Sir Edmund G. Loder, Bt., Vice-President, in the Chair.

The Secretary read a report on the additions that had been made to the Society's Menagerie during the month of November 1907.

Mr. R. H. Burne, F.Z.S., exhibited the feet of a Common Duiker (*Cephalophus* sp.) with extensive and more or less symmetrical overgrowth of the hoofs. The overgrowth was most marked in the fore-feet, each hoof showing a tendency to an inward spiral twist. The specimen was presented to the Royal College of Surgeons' Museum by Mr. Griffin, of the Pretoria Museum, Transvaal. The Antelope was shot (wild) by a farmer, in stony bush veldt country about 40 miles from Pretoria. Nothing unusual was noticed in its gait or running powers.

Mr. F. E. Beddard, F.R.S., Prosector to the Society, exhibited a skin of the rare Marsupial *Dactylopsila palpator* (A. Milne-Edw.), which had been placed in his hands by Dr. C. G. Seligmann, F.Z.S.

A collection of Molluscan Shells, Corals, &c. collected in the Pamban Channel, Southern India, was exhibited on behalf of Mr. C. M. Venkataramanujalu.

The Secretary, Dr. P. Chalmers Mitchell, F.R.S., exhibited preparations of the intestinal tracts of the Polyprotodont

---

* This Abstract is published by the Society at 3 Hanover Square, London, W., on the Tuesday following the date of Meeting to which it refers. It will be issued, free of extra charge, to all Fellows who subscribe to the Publications, along with the 'Proceedings'; but it may be obtained on the day of publication at the price of *Sixpence*, or, if desired, sent post-free for the sum of *Six Shillings* per annum, payable in advance

Marsupials *Phascogale penicillata*, *Sminthopsis larapinta*, and *S. crassicaudata*, made from specimens kindly lent him for the purpose by Mr. H. C. Beck, F.Z.S., and remarked on the simplicity of the patterns displayed by the intestinal tracts of these and other *Dasyuridæ* as contrasted with other Marsupials.

Dr. C. W. Andrews, F.R.S., F.Z.S., on behalf of Dr. R. Broom, C.M.Z.S., gave an account of a communication, illustrated by lantern-slides, on the origin of the Mammal-like Reptiles.

Mr. G. A. Boulenger, F.R.S., Vice-President of the Society, gave an account of a memoir entitled "A Revision of the African Silurid Fishes of the Subfamily *Clariinæ*."

Prof. E. A. Minchin, F.Z.S., described a new species of Hæmogregarine from the blood of a Himalayan lizard, *Agama tuberculata*, from Kasauli, India.

The next Meeting of the Society for Scientific Business will be held on Tuesday, the 14th January, 1908, at half-past Eight o'clock P.M., when the following communications will be made:—

1. Dr. W. A. Cunnington, F.Z.S.—Description of a Biological Expedition to Birket el Qurun (illustrated by lantern-slides).

2. Mr. O. Thomas, F.R.S., F.Z.S.—The Duke of Bedford's Zoological Exploration in Eastern Asia.—VI. List of Mammals from the Shantung Peninsula, N. China.

3. Mr. F. E. Beddard, F.R.S., Prosector to the Society.—On the Musculature and other Points in the Anatomy of the Engystomatid Frog, *Breviceps verrucosus*.

Communications intended for the Scientific Meetings of the Zoological Society of London should be addressed to

P. CHALMERS MITCHELL,

Secretary.

3 Hanover Square, London, W.

December 17*th*, 1907.

November 26, 1907 (*continued*).

December 10, 1907.

LIST OF PLATES.

1907, pp. 747–1121.

NOTICE.

The 'Proceedings' for the year are issued in *four* parts, paged consecutively, so that the complete reference is now P. Z. S. 1907, p. . . . The Distribution is as follows:—

Papers read in January and February, issued in June.
„ „ March and April, „ „ August.
„ „ May and June, „ „ October.
„ „ November and December, „ „ April.

'Proceedings,' 1907, pp. 447–746, were published on October 9th, 1907.

The Abstracts of the papers read at the Scientific Meetings in November and December are contained in this Part.

THE GEOLOGICAL SOCIETY OF AMERICA

OFFICERS, 1918

President:

WHITMAN CROSS, Washington, D. C.

Vice-Presidents:

BAILEY WILLIS, Stanford University, Cal.
FRANK LEVERETT, Ann Arbor, Mich.
F. H. KNOWLTON, Washington, D. C.

Secretary:

EDMUND OTIS HOVEY, American Museum of Natural History, New York, N. Y.

Treasurer:

EDWARD B. MATHEWS, Johns Hopkins University, Baltimore, Md.

Editor:

J. STANLEY-BROWN, 26 Exchange Place, New York, N. Y.

Librarian:

F. R. VAN HORN, Cleveland, Ohio

Councilors:

(Term expires 1918)

FRANK B. TAYLOR, Fort Wayne, Ind.
CHARLES P. BERKEY, New York, N. Y

(Term expires 1919)

ARTHUR L. DAY, Washington, D. C.
WILLIAM H. EMMONS, Minneapolis, Minn.

(Term expires 1920)

JOSEPH BARRELL, New Haven, Conn.
R. A. DALY, Cambridge, Mass.